AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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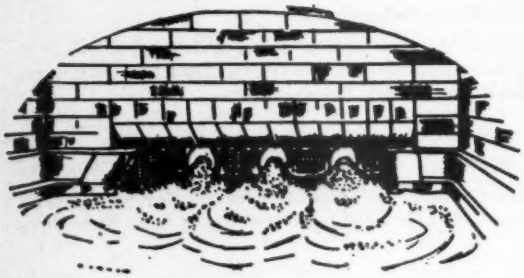

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THE GLASS INDUSTRY

VOLUME 35, NUMBER 6, JUNE, 1954

SOME APPLICATIONS OF RADIOACTIVE TRACERS TO GLASS PROBLEMS

By I. PEYCHES, Director of Research

St. Gobain, Chauny & Cirey, Paris, France

Translated from Silicates Industriels, August-September 1952

By RITA BRANTLINGER*

Editor's Note: Since the work reported in this paper was done some three years ago, it was felt that mention of subsequent work should be made. Dr. Peyches, therefore, has kindly furnished a brief resume of the more recent work, which comments follow at the end of this translation.

The relative ease with which it is now possible to procure radioactive isotopes, the simplicity, and the moderate cost of the necessary installations for studying the various problems using these tracers have greatly contributed to the expansion of this new method of research in many industries.

During the past two years, especially in English literature, rather numerous works interesting to glass and ceramics have appeared. Since 1949 the Department of Ceramic Research at Alfred University in New York, U.S.A., in collaboration with the Bureau of Naval Research, Washington, D.C., has undertaken a vast program on isotope utilization.

J. R. Johnson has outlined the possibility of using tracers for studies of corrosion of refractories by glass[1] in order to measure the loss of certain volatile constituents, such as selenium or lead[2], etc. Tracers are particularly well adapted to certain control operations, such as the process of dealkalinization[3], and constitute a new tool for the study of the internal structure of glasses[4,5].

In a few words we are going to consider the principle of the method, the minimum equipment required and the necessary precautions which must be taken since radioactivity is involved.

In atomic piles, together with other radiations, an enormous number of neutrons is emitted. The neutron flux is not necessarily dependent on the power of the pile. Zoé, the French pile at Chatillon, actually functions with a power of 8 Kw and produces 5 x 10^9 neutrons per cm^2 per second. A substance, introduced into the pile through openings in the surrounding concrete shield, is irradiated by these neutrons. By the capture of neutrons, a certain number of atomic nuclei of the constituent elements is transformed into isotope nuclei which are generally unstable and therefore radioactive. On leaving the pile, the irradiated substance remains chemically the same because its orbital electrons, and especially the valence electrons, are unchanged. It will follow all the customary chemical and biological processes but it will, at any instant, announce its presence because of the radioactivity which it emits. The concentration can be measured quantitatively with an extraordinary precision, because the individual disintegration of an atom can be detected. Therein lies the basic principle of the method. This artificially-created radioactivity decreases according to well-known laws, and the period, incorrectly called the life time, designates the time necessary for half of the activity to disappear. Therefore, the duration of measurements is related to the irradiation by laws of time which must be followed.

The apparatus to be employed in order to use the method is simple. The essential tool is the well-known Geiger tube, generally placed in a lead shield. The counting of impulses is accomplished by a complex electronic arrangement, the Autoscaler. Known in France under the name of scales (scale of 10, of 100, and so on), it is capable of counting up to 10,000 counts per minute and of totaling the counts received during a chosen time interval.

A minimum of survey equipment is necessary for personnel protection. The human body, among other or-

* Librarian, Pittsburgh Plate Glass Company, Glass Division Research Laboratories, Creighton, Pennsylvania. The translator wishes to acknowledge the help of K. M. Laing and K. B. McAlpine

ganisms, is used to receiving cosmic radiation. It constantly repairs the resulting tissue damages. It would repair them at the same rate as the destruction if the dose were increased by a factor of six. But, further, the damages would accumulate, and finally would endanger human life if other circumstances did not terminate the experience. For reassurance, 120 years has been set. This corresponds to a cumulated radiation of 600 roentgen units. Therefore, in addition to cosmic radiation, one has "a right" to a certain quantity of artificial radiation and this has been set at 0.5 r per week or 100 mr per day. Whether the permissible dose is received gradually or by a single concentration, the result is the same. There are two kinds of protection: the film badge which cumulates the effects and the portable electrometer which only indicates the daily dose in the evening. Moreover, a monitor should constantly measure the critical zone in the testing laboratory so that the personnel can be alerted to all abnormal radioactivity.

The pile, the generator of radioactive isotopes, is necessary for radioactive research. Actually, the American piles, and particularly Oak Ridge, supply the laboratories with most of the isotopes. In England, Harwell is the source of supply. In France, Zoé (Chatillon) furnishes a sufficiently large number of isotopes with the exception of C^{14} which will be obtainable from the new pile under construction at Saclay near Paris.

Before introducing an irradiated element into a glass or a ceramic, one should try to irradiate the glass or the ceramic in a lump form. All the constituent elements are bombarded, and their emissions are superimposed.

Table 1 indicates the isotopes available for certain glass and refractory constituents. The intervention of three factors is immediately noted: the life time about which we have spoken, the effective cross-section which is imposed by the proton-neutron distribution of the nuclei, and the percentage of activation which arises from the fact that it is sometimes only one natural isotope present in the base element which is activated. This is the case for silicon in which Si_{30}, present only in the natural element in the proportion of 4%, alone is activated by the neutrons.

Finally, the irradiation of a glass, above all, will be influenced by sodium if the measurement is made only at the end of many hours.

During the course of an experiment, various glass samples with a surface area of 1 cm^2 and a thickness of 2 mm had been activated in Zoé for 50 hours (a very important irradiation since, as we have said, in order to measure anything, 5 mm of lead were interposed be-

TABLE II

Sample	*I*	*II*	*III*	*IV*	V
SiO_2	71	70.05	80.25	73.3	62.05
SO_3	0.5	0.30	0.25	0.55	0.25
B_2O_3	0.7	....	12.35	....	11.30
Al_2O_3	1.15	2.90	2.10	0.80	6.90
Fe_2O_3	0.06	0.80	0.07	0.13	0.07
CaO	8.15	8.35	0.10	7.80	0.05
MgO	0.95	2.60	0.10	1.00	0.05
Na_2O	15.95	13.65	3.20	16.00	10.80
K_2O	0.05	0.50	1.55	0.15	0.15
ZrO_2	....	....	....	....	8.40
MnO	....	0.75	....	....	....
BaO	1.25	....	....	....	....
Activity apparent in counts/min.	17,800	14,400	4,060	15,500	13,500

TABLE I

Radioelements obtained by irradiation at the atomic pile of the principal elements entering into the composition of glasses

Irradiated Component in the Element				*Radioelement Obtained*				
Symbol	*Atomic Mass*	*Abundance %*	*Effective Section*	*Symbol*	*Atomic Mass*	*Period*	*Reaction of Formation*	*Radiation*
B	10	18.4	3,900	Li	7	Stable	n, α	Stable Element
Na	23	100	0.5	Na	24	14.8 hr.	n, γ	β (1.4) γ (1.4-2.8-2.7-3.2-3.7)
Mg	26	11.3	4.8×10^{-2}	Mg	27	10.2 min.	n, γ	β (1.8) γ (0.64-0.84-1.02)
Al	27	100	0.18	Al	28	2.4 min.	n, γ	β (3.3) γ (1.8)
Si	30	4.2	0.12	Si	31	2.8 hr.	n, γ	β (1.8)
P	31	100	0.2	P	32	14.3 d.	n, γ	β (1.7)
K	41	6.6	1	K	42	12.4 hr.	n, γ	β (3.5)
Ca	44	2.06	0.6	Ca	45	150 d.	n, γ	β (0.2-0.9) γ (0.7)
Ca	48	0.18	0.2	Ca	49	8 min.	n, γ	β (2.3)
Ca	49	....	....	Sc	49	2.5 hr.	O, β	β (1.8)
Fe	54	5.84	2.1	Fe	55	4 yr.	n, γ	K
Fe	58	0.31	0.32	Fe	59	46 d.	n, γ	β (0.26-0.46) γ (1.10-1.30)
Zr	94	17	0.1	Zr	95	67 d.	n, γ	β (0.4-1) γ (0.85)
Zr	96	2.8	0.29	Zr	97	17 hr.	n, γ	β (1.25) γ (0.1)
Pb	208	52.3	0.001	Pb	209	3.3 hr.	n, γ	β (0.7)

tween the sample and the Geiger counter). The activity is represented in Table II.

It can be seen that if the classification is correct, certain masking effects interfere on the one which imposes the sodium (sample V containing zirconium is more active than the proportion of Na would indicate) and thus, a dosage of sodium, for example, cannot be directly obtained.

On the other hand, I point out in passing that the natural potassium contained in a non-irradiated glass is determinable, and in our experimental conditions furnishes 4.75 counts/minute for each per cent of composition.

These preliminary explanations being given, I want to show by three practical examples how the general method can be used, the order of magnitude of the phenomena to be measured and what one can look for as information.

The creation of a tracer laboratory at the Centre de Recherche des Glaceries de Saint-Gobain was decided upon two years ago. In France, specialized personnel is easily acquired from the courses organized by the Commission of Atomic Energy. The formation of a research staff and the installation of the apparatus at the laboratory prevented the undertaking of work until six months ago. Therefore, these are some preliminary results which we are going to present and, as we have said, only by way of example.

The first problem is the determination of convection currents in the glass furnace. The tracer method has been used for this purpose for a long time, either by substituting barium for calcium, an element easily identified, chemically determinable and not causing any sensible disturbance in the customary properties of the glass, or by introducing a colorant, cobalt oxide or chromium oxide whose trace can easily be followed in the furnace. However, the colorant contaminates a part of the glass.

At first sight, to label an element in the composition by artificial radioactivity is an ideal operation, because the ordinary properties are not modified in any way, its effects finally disappear and the detectibility is extraordinary. Difficulties present themselves upon examination of the problem. In order that the samples can cover the normal spreading of the marked glass without being too badly affected by aging, the radioactive element should have a sufficient life time. On the other hand, the life time should be sufficiently short, so that during its utilization the finished glass does not give rise to harmful irradiation. During the fabrication, the ultimate destination of drawn glass, of a bottle or of a mirror is ignored, and it can be imagined what would happen if this radioactive glass were used, for example, to make a photographic plate, inactinic screens or bottles for biological use.

Therefore, each type of furnace imposes a particular choice; moreover, this is rather limited. For a small capacity furnace (neighborhood of 12 tons) producing two tons of a very weak sodium content glass per day, we have used isotope sodium 24 with a period of 14.8 hours, a beta emitter of 1.4 MeV and γ (3.6) introduced into the composition under the form of a carbonate. Activated in the Zoé pile, the carbonate presented an initial activity of 36 millicuries for 20 grams of material. This material had been dispersed in 25 kg of batch and was put into the furnace at the instant zero, less than six hours after its departure from the pile.

From this time on, samples have been periodically taken from different points of the furnace and where possible from different depths. The withdrawn glass was rapidly chilled, powdered and 5 gm of this glass was introduced into the lead housing (Geiger counter with a 25 mm window from Tracerlab (Boston)).

At the end of nine hours, the number of pulses recorded on the Autoscaler had reached a maximum of 1,400 counts per minute at the throat. Twenty-five hours after the experiment had begun, in spite of the diffusion of the radioactive element and its elimination attributable either to the drawing or to its aging, the scaler still registered 300 to 400 counts per minute, very comfortable figures when compared with the noise from the background which was 25 per minute (spontaneous activity due to cosmic rays).

Rough results have been corrected for the decay to the moment of measurement by the counter by using the classic relation

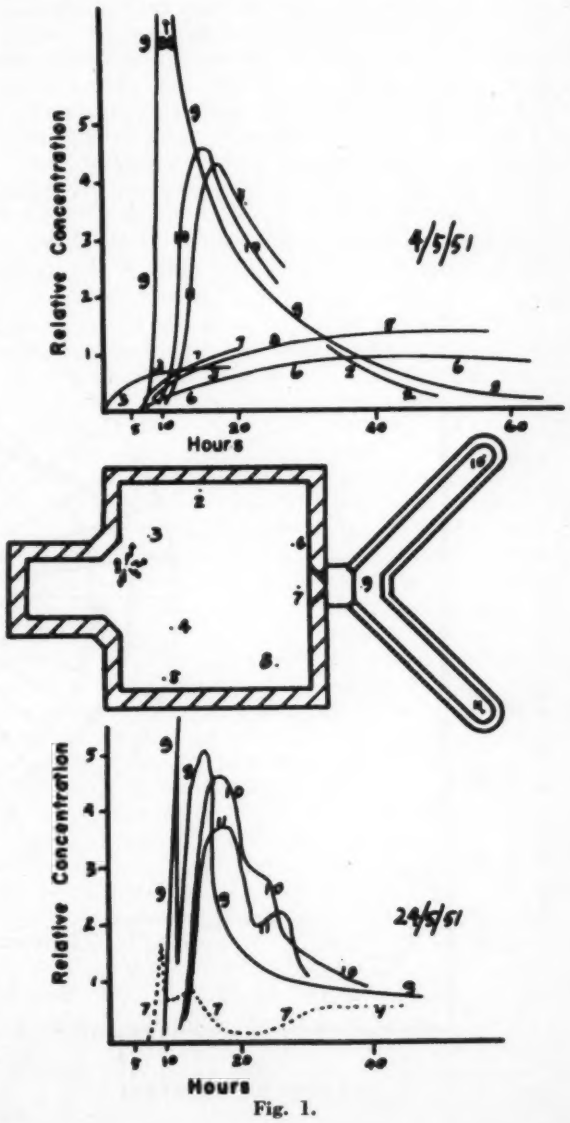


Fig. 1.

$\frac{dN}{dt} = \frac{dN_o}{dt} e^{-\lambda t}$, and $\frac{dN}{dt}$ $\frac{dN_o}{dt}$

being respectively the disintegration rate at the initial instant and at the instant t, and λ the radioactive constant of the isotope.

These results should be subjected to careful criticism, because the flow of radiosodium across each point of a cross-section of the furnace is not generally known. If these surface samples are accurate, the samples taken from the depth by the ferret are inaccurate. On the other hand, some interesting samples may be procured from certain points of the path of glass, such as the resurgence at the throat or the discharge from the feeders. Indeed, it should be noted that the curve giving for these points the activity as a function of time should represent constant areas (after correction for the decay) since these areas measure the total activity flowing from the doghouse to the machine.

However, the information thus collected is extraordinarily interesting. In the present case, the curves of corrected activity as a function of time are reproduced in Fig. 1. They show that none of the new glass had reappeared *on the surface* of the melting tank until nine hours after it had been put into the tank, when a sudden and considerable radioactivity took place at the rising of the throat. From examining the obtained results, point by point, we have deduced that the transversal convection in this type of furnace was insufficient, and that in order to directly reach the throat, a veritable river of new glass flows and breaks in between the regions of the old glass. During the first experiment, 40% of the isotope had passed to the throat in 20 hours and 60% in 40 hours, thus emphasizing the poor homogenization taking place in this furnace whose drawing rate was only 1/6 of its total capacity.

As a result of these investigations, a different direction of flame was adopted and the glass was lightly colored by adding 0.450 kg of iron oxide for 100 kg of sand. The new temperature gradient has facilitated the transversal surface flow, and a new test using 30 gm of radiosodium carbonate with an initial activity of 43 millicuries has been attempted. The outburst of radioactivity is evident at the throat after 11 hours, and reaches the relative value of 5.7 rather than 8.4 as in the first experiment (the unit corresponds to a supposed radioactivity uniformly distributed in the glass mass). In 20 hours, only 30% of the isotope had passed to the throat, and 48% in 40 hours. Despite the improvement, these new investigations confirm that the form of this furnace is not suitable for obtaining homogenous glass and that the furnace should be reconstructed.

Being given the statistical character of the disintegration, the effect, if it is weak, can be separated from the background noise, in order to measure it with the condition wherein a very large number of pulses spreading over a sufficiently long space of time is counted. When the radioactivity has notably decreased, the time interval of counting should increase so as to preserve the same precision. The activity decays during this time. A limit is quickly reached, especially since the selected samples accumulate and cannot be measured with sodium 24. The possible error after 50 hours, in the conditions of the experiment, was already 50%.

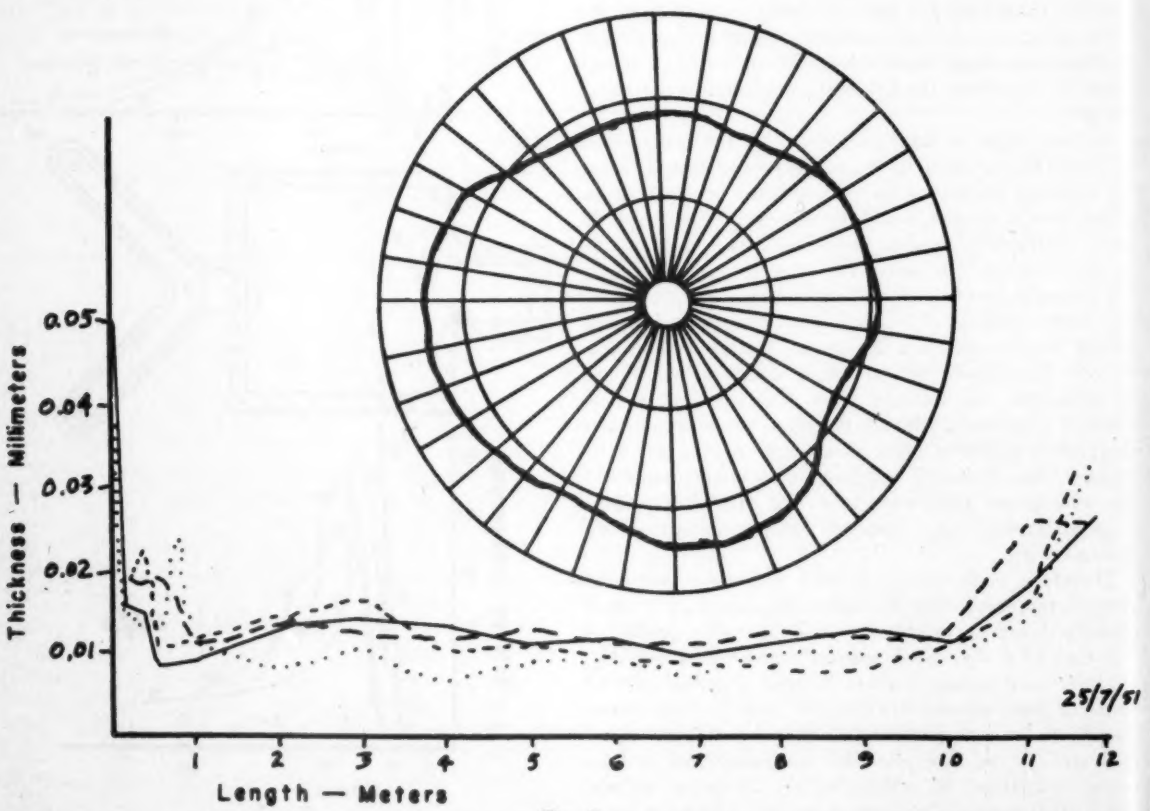


Fig. 2.

Therefore, with a furnace, total capacity of P_o tons and from which p tons are drawn daily, the furnace is said to have a withdrawal rate of $\tau = \frac{P}{P_o}$ and a spreading out period $\pi = \frac{1}{\tau}$ days. These definitions have only a convenience value; in particular, it should not be thought that all glass from the furnace existing at the instant zero has been increased to the time π; above all, the study of convection currents has led to the observation of a furnace during this time π. Therefore, at the time zero, if there is introduced an isotope presenting a radioactivity a which will be diluted in the furnace at the same time that it will decay, the residual radioactivity measurable to the time π can be calculated. In supposing that the homogenization had been perfectly effective, the initial radioactivity proves to be diluted in $P_o + \pi p = 2 P_o$ tons. The 5 gm sample would present an activity $\frac{a}{2 P_o} e^{5 \times 10^{-6} \lambda t}$ (t being equal to 1440 π because it should be expressed in minutes, in which case the constant of λ of radio-sodium is 0.047). The millicurie representing 37×10^6 disintegrations per second and a measurement satisfactory with Na^{24} requiring 100 counts/minute, the initial activity to be introduced into the furnace can be easily determined. Actually, there passes at the beginning a radio activity higher than that which would correspond to perfect homogenization. Thus, fewer isotopes remain in the furnace, and it is necessary to double or triple the initial dose. In practice, it can be admitted that it is necessary to introduce at the minimum 1 millicurie per ton of glass capacity of the furnace. (In our tests 3 millicuries per ton had been introduced.) Therefore, it is evident that the method, such as it is, is inapplicable for large furnaces which easily reach a 1000-ton capacity. The initial dose required many precautions which are difficult to take in the batch house and at the time of putting it into the furnace. Moreover, in order to avoid the contamination by dust from the doghouse, a preliminary melt was made at the laboratory with all the required safeguards, and the thus labeled glass was put into the furnace. In any case, it is further indicated that attention should be directed toward an element of average life so as to be able to make long measurements which permit the separation of interesting signals from the background and, therefore, of accepting a much weaker initial radioactivity.

The most indicative element is strontium 89, of which we will speak in the following example.

Our second example relates to a control operation. For many years, there has been evident in France[6] a unique technique of drawing steel bars using molten glass as a lubricant for the draw plate. A disk, or rather a flat cylinder named "the shell", a vitreous product whose nature should be matched to the desired operation, is interposed between the piece previously heated to white heat and the opening of the drawplate. Under a pressure of 10,000 kg/cm², the piece is pressed against the drawplate. The glass melts and covers the bar which spurts forth reaching several tens of meters in length. The phenomenon is difficult to study because it takes place in a few seconds. Now it is understood that the length drawn, or the number of operations which can be endured by the same drawplate, depends on the uniformity of the vitreous lubricant. Although the thermal system of the drawplate, the container and the work piece changes in an instant, the progressive and regular fusion of the glass was the desired goal requiring a knowledge of the spreading of the glass on the drawn bar.

Since the number of measurements to be made on a bar of such length and on the many generatrices requires many days, radio-sodium was not suitable. M. Le Clerc, engineering specialist on these questions at the laboratory of Saint-Gobain, selected strontium 89 as a substitute for calcium. The life time of Sr_{89} is 55 days; consequently, all the time necessary to make the measurements can be arranged. (This is a β emitter of 1.50 and 1.32 MeV without γ.)

The carbonate of radio-strontium 89 had been introduced into the experimental glass melt in the ratio of 0.5 gm to 5 kg of glass. At the beginning, the activity was 200 microcuries. The glass thus melted and powdered had been mixed with 5 kg of non-labeled glass in order to obtain a sufficient quantity of calcined glass to fabricate twenty shells. That is, each one presented an activity of the order of ten microcuries. These shells were used to draw round steel bars about 30 mm in diameter and 25 meters in length.

The accomplished measurements following four generatrices (Fig. 2) permitted with great precision the determination of the thickness of the glass film coating the bar, thickness of 15 to 20 microns which could not be detected by chemical analysis, being given above all that the ingot carries away the dross of the salt bath which had been used to reduce the temperature. In a subsequent experiment, the successive stages of the shells will be marked, permitting the study of the way in which the fusion progresses as a function of the diffusivity of its constituents.

The last example relates to research on the polishing process. For a long time it has been known that specialists were uncertain whether abrasion or flow explained this process. Again, radioactive glass supplies an interesting contribution to this question. A standard glass labeled with radio-strontium 89 had been polished with felt and rouge under a pressure of 90 gm/cm², pressure of the order of magnitude to that customarily used by industry. The experiment was periodically interrupted in order to withdraw 2cc from the slurry and to make the radioactive measurements on the felt and in the slurry from the pot (100 gm of rouge). The period, which was originally 2 minutes, had been extended to 5, then 10 and finally to 30 minutes. All the calculations being made, 1 pulse/minute measured on the polisher corresponded to 3×10^{-5} gm of glass, and measured on the rouge to 5×10^{-5} gm. Among other things it should be verified whether the rouge is saturated rapidly enough and whether the saturation is dependent on the period of uninterrupted working. Therefore, for all stops of 2 or 5 minutes, the saturation charge of the polisher was 0 mgm 2/cm². [Sic] For all 30-minute stops, the saturation was obtained at the end of 3 hours, and reached 1.2 mgm/cm² where it no longer varied up to 6 hours of working. In the same way the radioactivity measured in

(*Continued on page* 340)

MARKET STUDY HIGHLIGHT OF G.C.M.I. MEETING

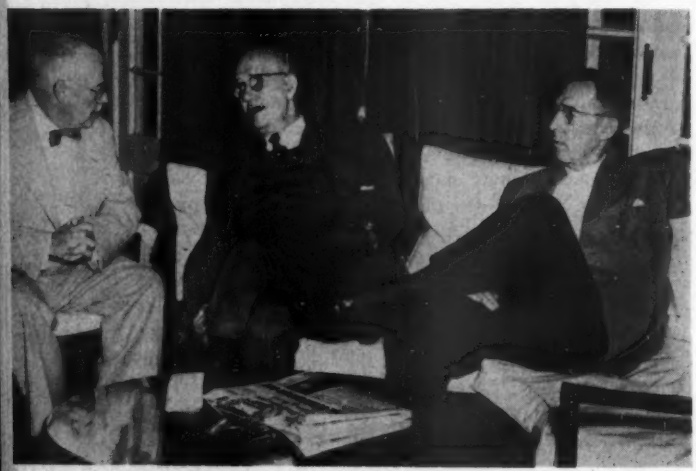
The Tenth Annual three-day meeting of the Glass Container Manufacturers Institute was called to order at The Greenbrier in White Sulphur Springs, West Virginia, Monday morning, May 17, by J. M. Foster, President of Foster-Forbes Glass Company and whose term of office as Institute President was completed with this meeting.

Reporting as President, Mr. Foster covered the many problems facing the industry, briefly reviewing its present position and the over-all business outlook. In analyzing the glass container industry's volume prospects for the balance of 1954, Mr. Foster said that on the negative side indications are that inventory adjustments of packaged products in trade channels have not proceeded with the rapidity expected last Fall, but that some further adjustment in this respect will undoubtedly influence new orders during the coming months.

On the optimistic side, Mr. Foster stated, "is the fact that personal income and disposable income are running at a level equal to the same period of last year. These are the indices which we are most interested in since our volume tends to follow these curves more nearly than the industrial production curve."

Newly-elected President of G.C.M.I. Joseph M. Nester, left, chats with out-going President J. M. Foster.

R. L. Warren, Sr., W. V. Fisher and C. R. Megowen.



Sounding what was more or less the keynote of this meeting, Mr. Foster then pointed out that there is plenty of buying power available for glass packed products and that the concern of the industry should be the doing of a real promotional and selling job.

Succeeding Mr. Foster to the presidency of G.C.M.I. is Joseph M. Nester, President of Obear-Nester Glass Company. Other officers named were First Vice President, Royden A. Blunt, President of Buck Glass Company; Second Vice President, J. Preston Levis, Board Chairman of Owens-Illinois Glass Company.

Elected to the Board of Trustees were J. Stanley Heuisler, President of Maryland Glass Corporation, and Edmund F. Ball, President of Ball Brothers Company. J. P. Levis and Philip O'C. White, President of White Cap Company, were re-elected to the Board, replacing B. W. Cremers, Wyandotte Chemicals Corporation, and W. V. Fisher, Anchor Hocking Glass Corporation.

The Board of Trustees is now comprised of the following members: J. S. Algeo, Hazel-Atlas Glass Company; E. F. Ball, Ball Brothers Company; R. A. Blunt, Buck Glass Company; J. M. Foster, Foster-Forbes Glass Company; H. C. Herger, Pierce Glass Company; J. S. Heuisler, Maryland Glass Corporation; J. P. Levis, Owens-Illinois Glass Company; F. W. McDonald, Glass Containers, Inc.; J. M. Nester, Obear-Nester Glass Company; F. B. Pollock, Thatcher Glass Manufacturing Company; and P. O'C. White, White Cap Company.

As is customary, the reports of the chairmen of the Nine Standing Committees of the Institute were submitted to the Board of Trustees. Two of these written reports were supplemented orally by Ralph A. Lind, Chairman of the Labor Committee, and Frank B. Pollock, Chairman of the Board of Thatcher Glass Manufacturing Company and Chairman of the Committee on Market Research and Promotion of the Institute.

While the meeting program covered all of the usual interests of the Institute's members, by far the greatest emphasis was on market research and promotion. In this connection, R. L. Cheney, Director of Marketing for the G.C.M.I., outlined the organization, plans, policies and objectives of the new department of the Institute. Following Mr. Cheney's report, Dilman M. K. Smith, Vice President and Consultant of Opinion Research Institute, Princeton, New Jersey, delivered a talk with color slides, "Taking the Mystery Out of Market Research and Promotion".

Ford Sammis, Marketing Economist serving the G.C.M.I. on a consulting basis, gave the assembled members a detailed report of depth surveys of public attitudes on glass containers now in progress in various parts of the country. Another matter which received considerable attention was the work of the Sub-committee for Public Information.

Smith L. Rairdon, Vice President of Owens-Illinois Glass Company, commented on the progress of Keep America Beautiful, Inc., the newly-formed organization devoted to the idea of keeping America's highways and

Fred E. Fuller.

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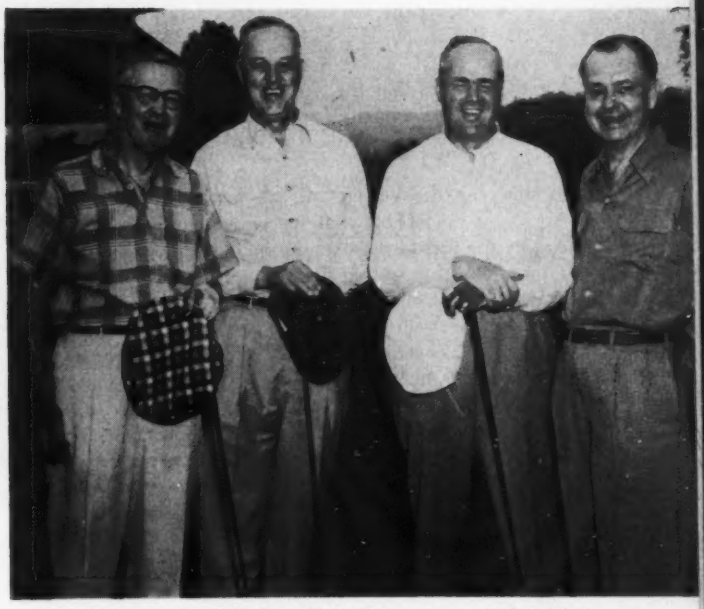
H. W. Kuni, J. M. Foster, V. L. Hall and F. E. Fuller.

Mrs. G. F. Collins, Jr., E. F. Ball and G. F. Collins, Jr.



D. R. Parfitt, C. D. Rau, P. S. Holmquest and M. A. Hellrung.

Mrs. F. B. Pollock, I. J. Collins, Mrs. J. M. Foster, Mrs. William White, Jr. and Mrs. R. L. Cheney.

Lowell Roesner, C. R. Megowen, R. L. Cheney and S. L. Rairdon.

recreational areas free from litter through a public educational campaign. Harry W. Kuni, G.C.M.I. Treasurer and Treasurer of K.A.B., supplemented Mr. Rairdon's remarks with an interesting report on a test roadside clean-up campaign being conducted in Maryland.

In connection with the litter problem, of primary interest to the glassmen and allied members assembled was the clear and forthright review of the Vermont case delivered by Fred E. Fuller, the Institute's General Counsel. Mr. Fuller lucidly outlined the action in challenging the constitutionality of the Vermont statute that prohibits the sale of malt beverages in non-returnable bottles and which statute was upheld by the Supreme Court of that State. Considering the possibility of an appeal to the Supreme Court of the United States, Mr. Fuller stated that he had recommended to the Board of Trustees of the G.C.M.I. that, notwithstanding the very arbitrary, discriminatory and provincial character of the statute and the decision of the Vermont Court, an appeal not be taken.

In analyzing the Vermont Court's action and the status of the litigation, Mr. Fuller pointed out that had the Supreme Court of Vermont premised its decision solely on the ground that this statute was an anti-litter statute and involved a constitutional exercise of police power, he would not have hesitated to recommend that an appeal be taken.

However, the Vermont Court, in addition to that holding, went on to hold that the real intent and purpose of the statute was to regulate the importation of intoxicating liquors and that in that field, under the 21st Amendment, the State was supreme irrespective of how arbitrary or discriminatory such legislation might be and without regard to the constitutionality of the statute from an anti-litter standpoint.

The Supreme Court of Vermont having so construed the legislation of that State, it was Mr. Fuller's opinion that notwithstanding the specious and unrealistic character of such construction, nevertheless the Supreme Court of the United States would regard such construction as being controlling. In such perspective, it was felt that the Supreme Court of the United States would therefore decline to consider the question of whether the statute involved constitutional exercise of police power as an anti-litter statute because such question could not be resolved without reversing the Supreme Court of Vermont as to the adjudged intent and purpose of the statute and its consequent validity under the 21st Amendment.

Victor L. Hall, G.C.M.I. General Manager, discussed the subject of aseptic glass packing and described the pilot unit developed by James Dole Engineering Company, which is virtually completed and ready for testing. Mr. Hall also touched on the industry's interest in similar developments by Food Machinery and Chemical Corporation and the Smith-Ball process.

Harry Kuni and Dr. John M. Sharf, of Armstrong Cork Company, form the glass container team cooperating with the Federal Civil Defense Administration and the National Canners Association on tests on processed foods under a nuclear explosion. This activity was described by Mr. Kuni and Dr. Sharf, both of whom will be present at the next series of blasts which will be devoted in part to studying the effect on civilian life, including an evaluation of glass container performance and the usability of packaged foods exposed to nuclear explosions.

Dr. Sharf is slated for the front lines, five miles back from ground zero; Mr. Kuni at a much more pleasant distance. It should be noted here, however, that neither man is considered by the industry to be expendable.

An innovation was a panel discussion, "What's on Your Mind?", during which members were invited to throw in whatever questions they had on scheduled subjects. Panel members were John S. Algeo, Container Design and Specification Committee; U. E. McFarland, Traffic; Ralph A. Lind, Labor Committee; L. G. Ghering, substituting for F. C. Flint, Chairman of the Testing Procedures Committee; and B. B. Holmes, Chairman of the Package Design and Specification Committee.

Social activities were as pleasant as they always are at a G.C.M.I. meeting. A delightful cocktail party was given by the White Cap Company; the Annual Banquet was its usual success; and the ladies luncheon and bridge-canasta party was well attended. The golf tournament brought out a large number of contenders for the many prizes.

The Fall Semi-Annual Meeting is scheduled for The Broadmore, Colorado Springs, Colorado, October 25, 26 and 27.

TOLEDO UNIVERSITY AWARDS FELLOWSHIPS

Awarding of the first two fellowships in silicate research at the University of Toledo has been announced by President Asa S. Knowles. The fellows are Glenn L. Calcamuggio of Toledo and Heyman C. Duecker of Marion, Indiana. Both will engage in research and study leading to the master of science degree. The curriculum is set up under the Institute of Silicate Research and the Division of Graduate Study at the University and has been approved by the University faculty.

Fellowships have been offered to meet the need for scientists trained in the silicate field. Recipients are paid $2500 a year while pursuing their work, which will normally be for two years in order to receive the degree.

Mr. Calcamuggio, 28, received the bachelor of engineering degree in Chemical Engineering with high honors at the University of Toledo in 1949. He was employed by the Illinois State Geological Survey in Urbana for one year and has been continuing his graduate study in glass technology at the university while working as assistant project engineer in glass research.

Mr. Duecker, 24, received the bachelor of science degree with high honors from Marion College and continued in graduate work at Ball State Teachers College and Purdue University. He has been employed by RCA Victor since July 1952 as research and development chemist.

Five such fellowships are now available. Two are sponsored by the Institute, two by Owens-Illinois Glass Company and one by Libbey-Owens-Ford Glass Company. Qualified students may apply for such fellowships to Dr. Wilhelm Eitel, Director of the Institute.

• The Chas. Taylor Sons Company has announced the appointment of Ferro Corporation, International Division, as their exclusive export representative for Central and South America, Japan and Union of South Africa.

DEDICATION OF THE INSTITUTE OF SILICATE RESEARCH

By WINGATE A. LAMBERTSON
University of Toledo, Toledo, Ohio

The Institute of Silicate Research was dedicated on May 15, 1954, to the service of science and industry and the training of future scientists at the University of Toledo, Toledo, Ohio.

The University of Toledo conferred honorary Doctor of Science degrees on Dr. Robert S. Sosman (Rutgers University) and Dr. F. H. Norton (Massachusetts Institute of Technology). President Asa S. Knowles very aptly described Dr. Sosman to the audience as the scientist who is the American counterpart of Dr. Wilhelm Eitel, Director of the Institute, when he was in Germany. Dr. Norton was commended especially for his outstanding work as a teacher of ceramic scientists.

Dr. Sosman gave the dedicatory address, "Destroying Refractories to Make Steel and Glass". It was a classic in the way he mixed his famous puns with a popular scientific version of refractories. Copies will be available for those who would like to have one.

Dr. Norton spoke in the first colloquium on "Some Aspects of Thermal Conductivity at Elevated Temperatures". He attributed all his data to his students, but his explanation of one of the most difficult problems concerning ceramic materials and the fact that the research had been directed by him made one feel fortunate to hear it from him personally. Dr. Norton's slides and discussion of the equipment that M.I.T. had used and the results they had obtained made the problem seem simple and conclusive. In the audience, largely scientists and engineers, not one person questioned either the methods or the results. One could not help wonder about the man-years required to determine the results of the M.I.T. thermal conductivity work, summed up in two or three "innocent"-looking graphs. Dr. Norton spoke of the plans of M.I.T. to extend this research work to ceramic materials of high porosity, powders and fibers.

In concluding his speech, Professor Norton, a teacher of many years, emphasized the value of basic research on the gradual level. He stressed that the graduate student lacked enough experience to know what could not be done, and as a result went ahead and did the impossible.

In introducing Dr. Sosman, Dr. Eitel told of his own experience as director of the Kaiser Wilhelm Institute of Silicate Research and of his difficulties during and after the second World War. Dr. Eitel went on to tell of his plans to build an even better Institute at the University of Toledo. With the freedom and relief from fear for the scientist in the United States, there is the best atmosphere for scientific progress.

It is always thrilling to meet and talk to the authors of scientific text books and treatises which are used and studied in silicates. Dr. Sosman's best known book is the Properties of Silica. Dr. Norton's Refractories is equally famous. Dr. Eitel's The Physical Chemistry of the Silicates has just been published and gives a starting reference for our Institute's graduate teaching. Dr. R. H. Bogue, famous for his The Chemistry of Portland Cement, was at the dedication. Drs. E. H. Kraus and L. S. Ramsdell, authors of the well-known text book of Mineralogy, also attended. Some of the other famous scientists attending the dedication were: Dr. Alexander Silverman, Dr. Cl. S. Ross, O. G. Burch, Dr. Kasimir Fajans, Dr. D. E. Sharp and many more who cannot be listed here but, because of their interest, are no less important for the success of the Institute.

Some of the United States governmental agencies which sent representatives or congratulations were: the Signal Corps Engineering Laboratories, U. S. Bureau of Mines,

Dr. Eitel confers with his faculty, Dr. Wolfgang Haller (standing) and Dr. Wingate Lambertson.

Dr. Eitel stands with Dr. F. H. Norton (left) and Dr. Robert S. Sosman (right) upon whom Honorary Doctor of Science Degrees were conferred.

U. S. Geological Survey, National Bureau of Standards and the Atomic Energy Commission. The American Ceramic Society was represented by the President-elect and the Trustee of the Glass Division. Other societies and universities, as well as private industries of many types, were either represented or sent their congratulations.

Congratulatory letters and telegrams were received from Belgium, England, France, Germany, Holland and Italy. With such enthusiastic support from the scientific world, how can the Institute become anything less than great?

Origin and Development of the Institute

Before the Institute of Silicate Research was organized, the University of Toledo had a glass technology course, which was part of the evening session program, under the direction of Professor Walter Burg, head of the Department of Chemical Engineering. Through this program, technical training was made available for students working toward masters degrees, with some of the instruction in charge of experts from the glass industry of the city. President Asa S. Knowles had the idea that the University could, in addition to training men, make a larger contribution to the field of scientific knowledge through a particular branch of science. He felt that this program would in turn bring outstanding scientists and fame to the University. President Knowles thought first of the glass technology program because of the concentration of glass industries in Toledo. He conferred with Mr. Jack H. Waggoner, then of the Owens-Corning Fiberglas Corporation, for advice on the organization of the program. Mr. Waggoner suggested that a man of international reputation be obtained as the director and recommended Dr. Eitel for the post. Mr. Waggoner's second suggestion was that the much broader field of silicate science be chosen as a base, rather than the more specialized field of glass. This would follow the pattern of the Geophysical Laboratory, founded in 1905, and the Kaiser Wilhelm Institute of Silicate Research, begun in 1926.

The first plans were considered in 1951 for the Institute of Silicate Research. President Knowles and Mr. Waggoner conferred with a number of interested persons to persuade different sponsors to provide money for the Institute. These sponsors are: The University of Toledo, Columbia-Southern Chemical Corporation, Libbey-Owens-Ford Glass Company, Owens-Corning Fiberglas Corporation, Owens-Illinois Glass Company and the Pittsburgh Plate Glass Company. This type of financing by private industry and the city of Toledo is unusual today when the bulk of basic research is supported by the federal and state government.

Dr. Wilhelm Eitel accepted the position as Director of the Institute of Silicate Research in June 1952, and with his acceptance the sponsors provided the necessary capital. The appointment of a scientist to direct the work of other scientists is important for the morale of the entire staff. To help in the direction of the scientific effort, a technical advisory committee was formed representing the sponsoring organizations. A group of University scientists was affiliated with the Institute to assist the staff in carrying out its program. An administrative board of executives from the sponsoring organizations was formed to act in an advisory capacity for financial matters of the Institute. Dr. Knowles, as head of the University, accepted the budgetary responsibility. Dr. Eitel is responsible for the hiring of the staff, teaching and the direction of scientific programs. This dual system secures for the Institute both excellent scientific management and sound business organization.

Dr. Eitel was occupied during his first year in Toledo with the organization and planning of the Institute. Through a rigorous work schedule of 60 hours per week, he was also able to complete his book, The Physical Chemistry of the Silicates. In the summer of 1953, Dr. Wolfgang Haller and Dr. Wingate A. Lambertson joined the staff of the Institute to supervice the remodeling of the building, equipping of the laboratory and forming of a research program. Dr. Haller, from the University of Vienna, is a physical chemist who has specialized in the field of colloids and surface chemistry. Dr. Lambertson, from Rutgers University, is a ceramist who has specialized in the field of refractories and high-temperature ceramic reactions. The first experimental activities of the Institute started in January 1954. The first graduate student began full time work in April 1954. Ten full-time students can be trained at one time in the Institute; they are expected to have joined by September 1954. Thus, each graduate student will be able to work closely with his teacher while doing his basic research.

One major objective of the Institute of Silicate Research is the education of scientists. Because of his international reputation, Dr. Eitel has had requests from outstanding scientists from various foreign countries to come to the Institute to study. Since production methods and development processes are not usually the subject of basic research, the Institute may draw its students from all over the free world, without fear of competition. Ar-

(*Continued on page* 344)

SULPHUR IN GAS FOR GLASS WORKING

By H. K. RICHARDSON, Glass Working Consultant

The usual gas man is surprised when he is told that sulphur must be added to natural gas for successful operation of many glass forming operations or processes. Over the years he has been working to reduce the sulphur content of manufactured gas to below a minimum requirement of 15 grains per 100 cubic feet of gas or 0.025% by volume.

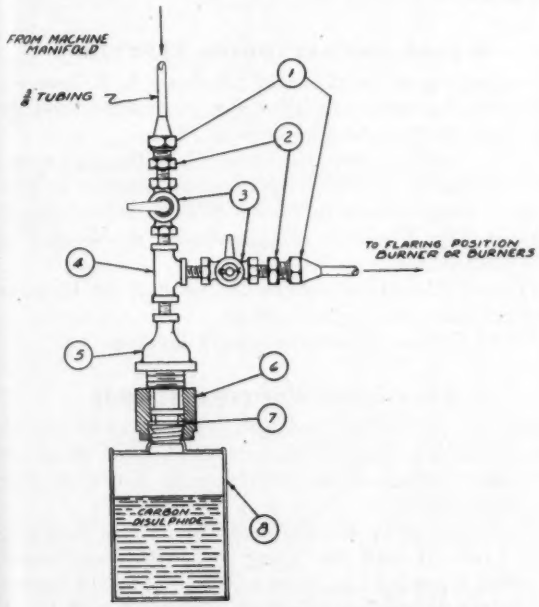
In 1929 the incandescent lamp industry of Cleveland, Ohio, was notified that the equipment supplying them with manufactured gas was obsolete and would not be replaced, and that they would have to use natural gas as the rest of the industries had done for 20 years. An intensive study of the flame characteristics of natural gas resulted in the development of proper piloted fine flame burners. However, certain operations, such as the flaring of glass tube ends, were not successful for the flare was wrinkled and the tools wore out quickly, indicating the absence of a lubricating ingredient in the gas.

An intensive detailed study of the composition of the gases showed that while the old manufactured gas contained 20 grains of sulphur per 100 cubic feet of gas, the natural gas only had one grain per 100 cubic feet.

On a cut-and-try basis, carbon disulphide was allowed to vaporize into the natural gas line at the flaring burner position. This worked successfully and became standard practice. Under ordinary room conditions, this gave about 30 grains of sulphur per 100 cubic feet of gas. The usual setup is shown in Fig. 1.

During the years the gas engineers were bringing down the sulphur content, the ampul makers were upping their speed of operation and encountering increasing trouble in the flaring work. To meet this difficulty, they dropped oil on the flaring tools, making a mussy and dirty job of the operation. They were now ready for the use of sulphur in the gas.

Today, the use of sulphur in natural gas used in the flame working of many glass operations is a necessity. The use of sulphur dioxide gas is now the preferred source of the sulphur and is in use in the glass working industry in two general categories:



TUBING CONNECTIONS TO FLARE MACHINE SHOWING ENRICHING OF NATURAL OR MIXED GAS WITH CARBON-DISULPHIDE

1 ⅜ MICHIGAN NUT
2 ⅜ × ¼ SAE TO IPT
3 ¼ FEMALE STOP
4 ¼ TEE
5. ⅜ × ¼ RED. COUPLING
6. ⅜ COUPLING
7. CORK GASKET
8. CS_2 CONTAINER

Fig. 1.

Glass Forming or Flame Working

In these operations, the sulphur in the gas flame acts like a lubricant and is commonly used in (1) the incandescent lamp and radio tube industries for flaring and shaping of tubing ends, pinching position on stem formation, mold position for making small bulbs from glass tubing; and (2) ampul and allied manufacturers have many operations helped by use of sulphur in the gas flames.

Glass Hardening

In this operation when the glass surface is subject to sulphur dioxide gas at an ideal temperature of 840-860°F., sodium sulphate is formed with the results: (1) surface cracks are reduced, and the surface is essentially neutral; (2) the strength of the surface is increased up to 20% in lime and lead glasses, see J.S.G.T. 1938, Vol. 22, pp. 357; (3) bloom is on the surface of glasses containing over 2% boron.

Methods of Application

The relative merits of carbon disulphide and sulphur dioxide.

Carbon disulphide is advantageous for small isolated units but must be handled carefully due to its inflammability.

Sulphur dioxide lubricates the pins cleanly while the disulphide tends to carbonize and needs more frequent cleaning.

Sulphur dioxide is obtainable in larger quantities and can be automatically proportioned to the factory lines.

Today, the use of liquid sulphur dioxide in tanks is preferred. The setup varies as noted below:

(1) *Isolated units.* These use the same arrangement as in Fig. 1; the gas is from small cylinders, reduced to 6 psi and fed into gas inlet, (5) Fig. 1, through an orifice.

(2) *Assembly rooms,* where both glass working and assembly is done. The cylinders are manifolded and the sulphur dioxide gas is piped into the room at 6-10 psi. Connections to work are as shown in Fig. 1.

(3) *Glass working rooms,* where only glass is worked, are supplied with natural gas to which the sulphur dioxide is added through proportionating rotometers in accordance with the demand. The usual rate is 1/10 cubic foot of sulphur dioxide per 100 cubic feet of natural gas.

(*Continued on page* 346)

OWENS-CORNING ELECTS VICE PRESIDENTS

Edward J. Detgen and William Keller have been elected vice presidents of Owens-Corning Fiberglas Corporation, according to an announcement by Harold Boeschenstein, President.

Mr. Detgen had seen service, since December 1951, as General Sales Manager of the Fiberglas General Products Division and will continue to headquarter in Toledo. Mr. Keller, since October 1951, had been General Factories Manager of the Fiberglas Textile Products Division. He will continue to make headquarters in New York City.

E. J. Detgen

Wm. Keller

A member of the Fiberglas organization since 1945, Mr. Detgen had been Sales Manager of the Building Materials Division before assuming his recent post. He had prior wartime government service in Washington, D. C., as Director of the Containers Division of the War Production Board and for several years previously was Chief of the Specialties Division of the U. S. Department of Commerce.

Mr. Keller, before assuming the post of General Textile Factories Manager, had served for 18 months as Manager of the Fiberglas textile products plant in Huntingdon, Pa. From 1942, when he joined the company, until 1950, he had worked in the Fiberglas general products plant in Newark, Ohio, in various supervisory capacities.

FOSTER-FORBES ELECTS OFFICERS

At the Annual Meeting of the Stockholders of Foster-Forbes Glass Company, all of the present Directors were re-elected. At the Board of Directors meetings, the following officers were elected: J. M. Foster, President; F. H. May, Executive Vice President and Treasurer; R. R. Board, Vice President and General Factory Manager; R. L. Wright, Secretary; and W. P. Forbes, Assistant Secretary.

NATIONAL SAFETY CONGRESS TO BE HELD IN OCTOBER

The 42nd National Safety Congress and Exposition is to be held October 18 through 22 in Chicago, Illinois.

Sessions on industrial safety are scheduled for the Conrad Hilton, Congress, Morrison and LaSalle Hotels; traffic safety sessions at the Congress Hotel; commercial vehicle and transit safety sessions at the LaSalle Hotel; farm safety sessions at the Palmer House; school safety sessions at Morrison Hotel; and home safety sessions at the Conrad Hilton Hotel.

ATOMIC BOMBARDMENT OF GLASS PLANNED

Scientists are planning an atomic bombardment of glass which they hope will solve the 5000-year old mystery of its structural makeup. Solution of the problem, researchers say, could open up a whole new world of uses for one of man's oldest and most useful materials.

By bombarding a square centimeter of glass surface with a continuous stream of 100 billion neutrons per second and studying the reaction, the scientists hope to uncover the secret of what holds glass together. With this knowledge, they plan to go a step further and see if a rearrangement of its present structure would make glass even more serviceable to man. Various structural changes might open the way, they think, to making glass even more durable, more heat resistant or more flexible.

Owens-Illinois Glass Company has announced that it has established a two-year post-doctoral fellowship at the Massachusetts Institute of Technology to carry on the research. The actual atomic bombardment will be conducted in one of the nuclear reactors at the Brookhaven, Long Island, Laboratory of the Atomic Energy Commission.

Along with the bombardment, the researchers will employ a technique discovered by the Nobel Prize-winning Indiana physicist C. V. Raman of using light beams to study the characteristics of materials. By directing a light beam through the glass, then measuring changes between the wavelengths of the light as it enters the glass and emerges, the researchers hope to learn the position of the atoms in glass and the strength with which they are bound together. The light tests will be run on the glass, both before and after it is bombarded to determine if the bombardment has in any way changed the glass structure.

WALSH REFRACTORIES ELECTIONS

In a meeting of its Board of Directors, A. J. Tomasek, formerly Executive Vice President, was elected President of Walsh Refractories Corporation.

Also elected to new offices were J. J. Duggan, named Vice President and retaining his former position as Manager of Glass Refractory Sales, and W. K. Schweickhardt, named Vice President and continuing as Manager of Refractory Sales.

Paul L. Hershfield remains Chairman of the Board of the firm and chief executive officer.

T. W. Gill was re-elected Secretary-Treasurer.

X-RAY DIFFRACTION SCHOOL

Plans for a Western X-ray diffraction school to be conducted during the week of June 21 through 25 on the Berkeley campus of the University of California have been announced.

Co-sponsored by the University Division of Engineering Extension and the X-Ray Department of General Electric Company, the school will be open to anyone interested in acquiring or furthering his knowledge of X-ray diffraction techniques and applications. The sessions will be divided between lectures and laboratory work. Guest speakers, authorities in their fields, will lecture on specific diffraction applications, and will be available for consultation.

Inventions and Inventors

Annealing and Tempering

Apparatus for Fire-Finishing Glass Articles. Fig. 1. Patent No. 2,666,277. Filed March 28, 1951. Issued January 19, 1954. Two sheets of drawings. Assigned to Owens-Illinois Glass Company by Burton A. Noble.

In the forming of bottles, numerous undesirable defects are formed on the upper end. These defects include ridges, seams, checks and cracks. To remedy these defects, bottles are subjected to a flame prior to their entry into the lehr. It is an object of this invention to provide an apparatus for effectively and efficiently removing these defects by applying a hot flame.

As a bottle 10 in Fig. 1 is carried into position by the conveyor 11, the continuously rotating fire-finishing apparatus operates to bring a paddle into position to hold the bottle in register with a burner 44. At this time the burner inlet 42 is brought into communication with the slot 52 (not shown) in the fuel distributing plate 50. Fuel is thereby supplied to the burner. When this occurs, the burner is in register with the bottle and adjacent to the pilot burner 49, thereby igniting the fuel. Upon further rotation of the table, the bottles are moved along in register with the burners until they are deposited on the conveyor. The paddles then swing away from the bottle and simultaneously the fuel to the burner is cut off since the burner inlet 42 moves out of communication with the slot 52. The bottles are then carried to the lehr 15.

The patent contains 6 claims and the following references were cited: 1,245,730, Johnson et al., Nov. 16, 1917; 1,502,201, Jaeger, July 22, 1924; 2,209,252, Stewart et al., July 23, 1940; 2,258,408, Cozzoli, Oct. 7, 1941; 2,338,841, Fedorchak et al., Jan. 11, 1944; 2,381,798, Benoit, Aug. 7, 1945; and 2,407,878, Greetham, Sept. 17, 1946.

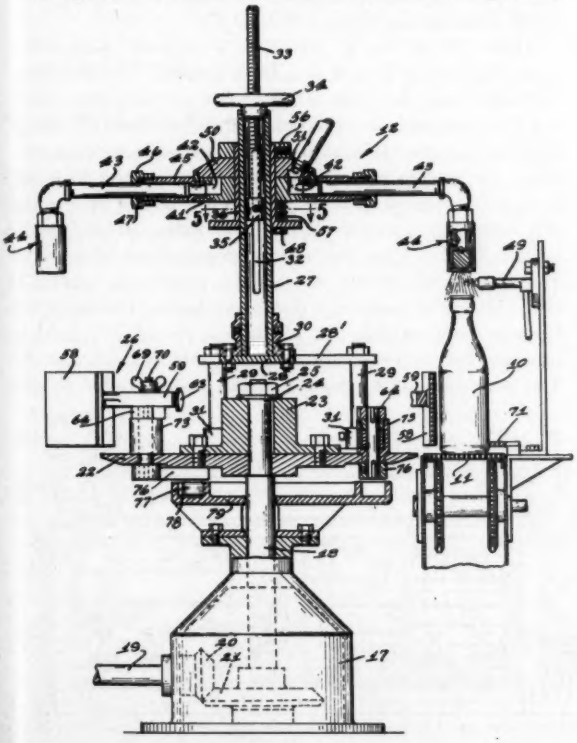


Fig. 1.

Feeding and Forming

Machine for the Manufacture of Hollow Glass Articles. Fig. 2. Patent No. 2,668,395. Filed November 28, 1950. Issued February 9, 1954. Two sheets of drawings. Jean Maillart.

This invention relates to a machine for the manufacture of hollow glass articles such as bottles and flasks. Figure 2 shows the machine in vertical elevation. Mounted on the pins 7a—7b, through the intermediary of mold carriers, are a roughing mold E. G. and a finishing mold F. G., respectively. Similarly, a roughing mold E. D. and a finishing mold F. D., respectively, are mounted on the pins 8a—8b through the intermediary of mold carriers.

The two pairs of molds, E. G.—F. G. and E. D.—F. D., are situated on opposite sides of a vertical axis X—Y and their arrangement is such that in the closed position of their shells, these molds are centered on the axis X—Y, which is the general axis of the machine. The only movement imparted to these molds is that corresponding to the opening and the closing of their shells.

These four molds may be closed around two neck molds B^1 and B^2, respectively, each of which is also actuated

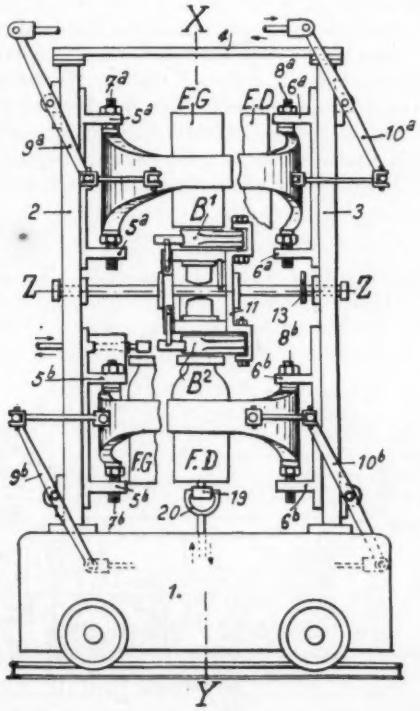


Fig. 2.

with opening and closing movements and which, in their stopping positions, are also centered on the general axis X—Y, which is thus common to the three pairs of molds.

Moreover, the neck molds may carry out together rotations of 180° about a horizontal axis Z—Z which encounters the general axis X—Y. The machine may operate in two different manners. In the first form of operation, called "simultaneous control" operation, the opening and closing movements, one for the roughing mold and the other for the finishing mold, cooperate successively in the manufacture of one and the same article. In the second form of operation, called the "individual control" operation, the respective opening and closing movements of the roughing mold and of the finishing mold depend upon individual controls. The advantages are that the roughing and finishing molds operate simultaneously and at a sufficient speed to maintain the molds at a suitable temperature.

The patent contains two claims and the references cited were as follows: 704,055, Leistner, July 8, 1902; 2,388,876, Smith, Nov. 13, 1945; and 11,214, Great Britain, May 16, 1903.

Ejecting Mechanism for Electron Tubes. Patent No. 2,662,344. Filed March 24, 1950. Issued December 15, 1953. One sheet of drawings (none reproduced). Assigned to Radio Corporation of America by Horace B. Knox.

The present invention relates to a glass forming apparatus utilizing molds having apertures for forming softened glass with one or more wires extending to predetermined shape. Means is provided for fully releasing and ejecting a stem assembly having lead-in wires stuck in or adhering to apertures in a mold. The apparatus is also capable of automatically and consistently ejecting the finished glass form on to a cushioned mounting thus avoiding breakage of the parts.

The patent contains six claims and the following references were cited: 796,470, Swan, Aug. 8, 1905; 972,203, Malton, Oct. 11, 1910; 1,136,275, Roehrich, Apr. 20, 1915; 1,911,742, Berry, May 30, 1933; 2,192,302, Errett, Mar. 5, 1940; 2,317,839, Westin, Apr. 27, 1943; 2,324,385, Gustin et al., July 13, 1943; 2,367,515, Moon, Jan. 16, 1945; and 484,315, France, June 29, 1917.

Guide Tube for Glass Feeders. Patent No. 2,665,525. Filed August 5, 1950. Issued January 12, 1954. Four sheets of drawings (none reproduced). Assigned to Henry C. Daubenspeck (one-half) and Samuel E. Winder (one-half) by Harold A. Youkers and Walter V. Vierling.

The feeder tube is mounted in trunnions at its upper end and disposed immediately below the shears that are associated with the glass feeder. In addition, there is a mechanism that engages the tube below the trunnions so as to swing its lower end in an arc about the trunnions. This operating mechanism is synchronized with the rotating table of the glass molding machine so that the tube swings over the path of movement of the mold table. The synchronization is such that the tube swings with each successive mold for a limited angular movement of the mold, at which time the charge of glass is dropped. By this arrangement, the charge of glass is given a lateral component so that it will descend cleanly into the lower end of the blank mold despite the lateral component of movement of the mold. After the discharge of the glass into the mold, the lower end of the tube is brought rapidly back so that it may perform a similar function in connection with a successive mold that moves across the charging path.

The present invention has means to enable the tube or the actuating mechanisms to be moved by such abnormally projecting parts of the molding machine without breaking the parts of either or without breaking the molding machine elements.

The patent contains 24 claims and 11 references were cited.

Molding of Glass Articles. Fig. 3. Patent No. 2,665,524. Filed March 3, 1950. Issued January 12, 1954. Six sheets of drawings. Assigned to Glass Labeling and Decorating Company by Ralph Brown.

This invention relates to a method of and apparatus for producing glass articles, particularly relatively large glass articles of bowl-like character which are suitable for use as components of illuminated signs and as transparent or translucent lighting fixtures for encasing electrical illuminating tubes and lamps.

Table 50 in Fig. 3 serves as a support upon which molten glass can be rolled to form a sheet. The glass may be ladled onto the table 50 from one or more glass melting furnaces and the apparatus turned on its pivot means 43 to bring the table adjacent the appropriate furnaces. After the molten glass has been placed on the table 50, it is rolled out to provide a sheet by means of a roller 90 extending transversely of the frame 30 above the table. At this time the now exposed sheet of glass is quickly and effectively covered by a blowing head 105 which is in the form of a dome-like hood. The head 105 has arms 106 which are pivoted to a rod 107 held in brackets 108 and extending transversely of the frame 30. The lower rim of the hood 105 has a sharp edge so that

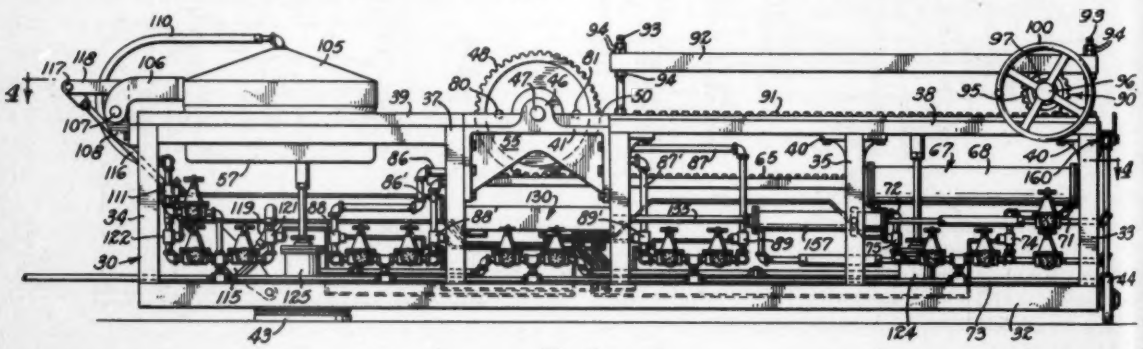


Fig. 3.

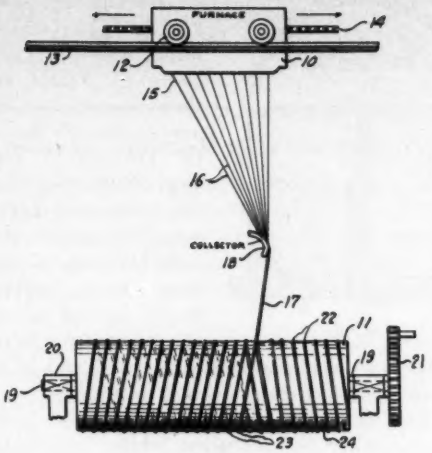


Fig. 4.

when the hood is lowered onto the glass sheet this edge sinks into the glass, thus forming a score mark or indentation in the glass adjacent the rim of the mold 57. When the blow-head 105 is in position against the glass sheet with its edges thus sealed, compressed air is introduced through a hose 110 to cause the sheet to be blown down into the mold and thus assume the desired shape of the mold.

After the glass sheet has been deformed into the mold 57, the tables 50 and 55 are disconnected and the blown article removed. Any article that can be blown from sheet glass can be made by the process. For example, cups, saucers, plates, jewel boxes, industrial articles are all possible.

The patent contains 26 claims and the following references were cited: 527,476, Bonta, Oct. 16, 1894; 645,375, Sievert, Mar. 13, 1900; 694,685, Sievert, Mar. 4, 1902; 2,333,076, Stewart, Oct. 26, 1943; and 1,233, Great Britain, June 8, 1901.

Glass Wool and Fiber

Method of Removing Starch From the Binder on Glass Cloth. Patent No. 2,666,720. Filed May 28, 1951. Issued January 19, 1954. Two sheets of drawings (none reproduced). Assigned to Glass Fibers, Inc., by Emil H. Balz.

In order to minimize friction in processing glass fibers while they are being drawn, a vegetable lubricating oil, starch and very small amounts of cationic, wetting and dispersing agents is applied. The presence of this binder aids in the textile operation but seriously affects the ability of the glass to form laminates with other materials, such as synthetic resins. Accordingly, when it is desired to form such laminates, treatment of the glass cloth to remove the binder material is required in order to obtain satisfactory adhesions between the cloth and the resin.

By treating the glass cloth containing the oil-starch binder material with a solution of urea at moderate temperatures, the starch and other agents of the binder are removed from the glass fabric. The oil component of the binder remains. The oil may be removed from the fabric to provide a thoroughly clean glass by (a) the use of a caustic treatment as described in co-pending application, Serial No. 228,623, filed May 28, 1951, or (b) by the use of an oxidizing agent as described in co-pending application, Serial No. 228,624, filed May 28, 1951, or (c) by a batch operation, or (d) by treatment in an autoclave with air or oxygen under pressure. The concentration of the urea may vary from 5 to 20 per cent. Wetting and detergent agents which may suitably be employed in the urea solution include Triton N-100, a product of Rohm and Haas Company, which is a concentrated wetting agent and detergent designed primarily for use in the textile trade.

The patent contains 10 claims and the following references were cited: 2,407,483, Ebaugh, Sept. 10, 1946 and 2,607,359, Oesting, Aug. 19, 1952.

Method for Producing an Open Mesh Fabric of Glass Fibers. Fig. 4. Patent No. 2,664,375. Filed June 9, 1949. Issued December 29, 1953. Two sheets of drawings. Assigned to Owens-Corning Fiberglas Corporation by Games Slayter.

An object of this invention is to produce a fabric of glass fibers having exceptionally high strengths as a result of the arrangement of the fibers predominantly as bundles of selected concentrations, which are disposed at predetermined angles relative to each other.

In Fig. 4, 10 indicates a glass melting furnace adapted to reciprocate back and forth the length of a rotatable winding drum 11 over which it is mounted. Before being wound on the drum, the filaments 16 are gathered into a single strand 17 by a collector 18 movable coincident with the furnace 10 as by being mounted on a part of the furnace structure. The winding drum 11 is mounted on a shaft 19 rotatably mounted in bearings 20. As the drum rotates and as the furnace 10 and collector 18 travel longitudinally back and forth over the length of the drum, the strand is spirally wound on the drum with the lead extending in one axial direction while the furnace is traveling in that direction and then with the lead extending in the other axial direction as the furnace reverses its direction of travel. Thus, a layer 22 of helical strand convolutions is deposited on the periphery of the drum and then another layer 23 of helical strand convolutions is deposited over the first, the strands in the one layer crossing the strands in the other layer at an angle which is predetermined by the relative movements between the furnace and the drum. Multiple layers may be built up on the drum with the strands in alternate layers being disposed generally in parallel relation.

The patent contains 13 claims and the following references were cited: 1,771,216, Gossler, July 22, 1930;

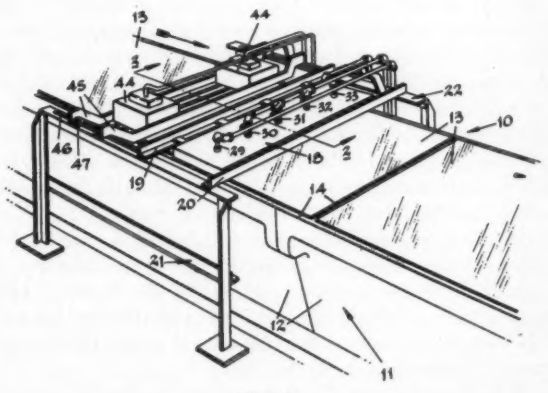


Fig. 5.

2,081,060, Modigliani, May 18, 1937; 2,234,986, Slayter et al., Mar. 18, 1941; 2,392,805, Biefeld, Jan. 15, 1946; 2,477,555, Roberts et al., July 26, 1949; and 2,574,221, Modigliani, Nov. 6, 1951.

Synthetic Resin Impregnated Glass Fabric and Method of Making Same. Patent No. 2,667,430. Filed March 4, 1953. Issued January 26, 1954. No sheets of drawings. Assigned to United States Rubber Company by James R. Wells.

This invention relates to polyester resin-impregnated glass fabric of greatly enhanced transparency and to a method of making the same. More particularly it relates to so-called "Photoply" material used for making phototemplates. Glass fabrics other than woven fabrics, for example, fabrics wherein glass fibers are randomly oriented as in the case in a felted mass of glass fibers, such as a mat or preform, may be used.

An example of the application is as follows: A 3.16-ounce glass fabric having a thread count of 60 x 58 and known as "116 construction" and embodying the sizing applied by the glass manufacturer is impregnated with the following formulation:

	Parts by weight
"Uformite F-240" (60% solids)	42
Styrene	58
Monodiethyl acid orthophosphate	0.075

The foregoing ingredients are mixed together just prior to use to give a mixture having a specific gravity of about 1.52 and a solids content of approximately 25%. Following impregnation, the fabric is dried to remove volatiles. The fabric is then impregnated in the conventional way with a peroxide-catalyzed commercial polyester resin known as "Vibrin" which is a solution of diethylene glycol maleate in monomeric styrene. The resulting material is highly transparent, dimensionally stable and is ideally suited for the manufacture of phototemplates.

The patent contains 6 claims and no references were cited.

Sheet and Plate Glass

Prevention of Curvature in Ground and Polished Plate Glass. Fig. 5. Patent No. 2,667,018. Filed June 3, 1949. Issued January 26, 1954. Two sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by Donald W. Dunipace and Ival G. Fowler.

The problem of distortion in ground and polished plate glass is a very serious one. The major factor in the production of wedge, and curvature or waviness, in commercially ground and polished plate glass is due to the fact that the glass blanks do not lie flat on the tables during grinding and polishing and, more specifically, that their failure to lie flat, particularly at their marginal portions, is due to a large extent to differentials in temperature between their top and bottom surfaces, which cause the blanks to bow or curl at their edges.

It has been found that glass blanks will lie flat on the grinding and polishing table if the temperatures are equalized on the opposite surfaces of the blanks while they are being laid on the tables and embedded in plaster. This treatment reduces the amount of wedge and curvature in the finished product.

A preferred form of apparatus for heating the blanks

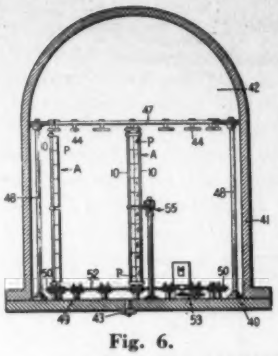


Fig. 6.

on the tables is shown in Fig. 5 which comprises a steam pan 18 mounted above the tables and in close proximity to the upper surface of the blanks 13. The pan 18 is in the form of relatively thin, hollow, rectangular sheet metal casing, the interior of which is divided into a series of compartments. Leading into the top wall of each of the compartments, substantially centrally, are steam pipes 29, 30, 31, 32 and 33, all of which are connected to a common manifold conduit 34.

The heating of the surfaces of the blanks is accomplished primarily by the steam which flows from the openings 36 and 37 (not shown) into contact with the glass surface and gives up heat as it condenses. By proper regulation of the steam supply to the pan, practically all of the steam flowing from the openings will condense on the glass beneath the pan so that little or no steam will escape around the edges of the pan. In order to control the temperature of the glass surface, thermostatically controlled valves are inserted in the steam line.

The patent contains 11 claims and the following references were cited: 694,711, Anderson, Mar. 4, 1902; 1,367,049, Jackman, Feb. 1, 1921; 1,872,697, Drake, Aug. 23, 1932; 1,959,225, Wilhelm et al., May 15, 1934; 2,282,942, Crowe, May 12, 1942; 2,339,158, Drake, Jan. 11, 1944; 2,363,631, Walters, Nov. 28, 1944; 441,017, Great Britain, Jan. 10, 1936; and 454,697, Great Britain, Oct. 6, 1936.

Glass Cutting Machine. Patent No. 2,667,691. Filed September 7, 1951. Issued February 2, 1954. Two sheets of drawings (none reproduced). Paul Marton.

This invention relates to glass cutting machines, and particularly a machine for firmly clamping a glass plate and for guiding a cutter in straight-line travel across the plate. Glass plates are clamped between two elongated bars while one of the bars is utilized as a slide guide and mounting for a cutter. The cutter is mounted on a carriage which is slidable and rectilinearly guided by an elongated bar. The cutting tool is forced by a spring against the glass, and hence any desired pressure is maintained and regulated.

The guide bar may also be mounted transversely of a base plate or abutment and afford a slight angular adjustment relative to the base plate, so that glass may be cut, if desired, along a line diverging slightly from a true perpendicular to the base plate.

The patent contains 3 claims and 11 references were cited.

Tube and Cane Machines

Means for Marking Glass Tubes. Patent No. 2,668,356. Filed April 24, 1951. Issued February 9, 1954. Four sheets of drawings (none reproduced). Assigned to the United States of America as represented by the Secretary of the Treasury by Richard H. Forbes.

The invention provides a novel apparatus by means

(*Continued on page* 330)

Research Digest

Mold Irons and the Glass Mold Situation

The glass industry is a highly diversified one. Methods of production range from the "hand blown" to the fully automatic high-speed machines producing many glass articles per minute. Machines have been developed to produce glass articles by press, press and blow, and blow-blow methods.

The glass industry has experimented with and changed glass compositions to meet the demand for a higher quality, more durable and a more salable article. Glass temperatures, as the glass is delivered into the mold, range from 2100° to 2600°F. When all of these factors are considered, it is too much to expect that any one mold iron will completly meet the varied requirements of the glass industry. E. R. Flatter in the April 1954 issue of the *Bulletin of the American Ceramic Society* presents a very comprehensive review of the various types of iron used for glass molds.

The general requirements for a good mold iron are well-known. It should be readily machinable, resist heat and corrosion, must be of high density and close grained in structure. The cavity must take a high polish to produce glass with a luster finish. It must resist scaling and have a stable character to resist dimensional changes or growth under the repeated heating and cooling to which it is subjected. Gray iron molds which are operated under these conditions at elevated temperatures increase in volume or tend to grow. At temperatures below approximately 1300°F., growth of gray iron is primarily due to the decomposition of iron carbide into ferrite and graphite. At temperatures above 1300°F., growth is attributed to the graphitization of the combined carbon, the oxidation of the silicon-iron matrix and the expansion of occluded gases.

A soft, high-carbon cast iron, cast against a chiller to produce a dense, close-grained structure fulfills the need for a good all-purpose mold iron. For some special applications, a low carbon unchilled iron is favored. Improvements can be made in heat resistance and growth properties by the use of suitable alloying elements.

A few years ago, tests were made in which 10 different alloying elements were employed to determine the effect upon the graphite particle size, shape and distribution, and also the effect upon the matrix structure. First, the alloys were added singly and then in combinations to a suitable base iron. In all, 24 test specimens were poured, chemical analysis made, photomicrographs taken, fracture and density noted, and tensile strengths and hardness values determined. After all the information was correlated and studied, the use of chromium, nickel and molybdenum when used in combinations of selected percentages proved to have the most favorable effect. Other elements, however, produced improved properties but were less desirable because of high cost and scarcity or because they were more difficult to get into solution.

The size, shape and distribution of the graphite flakes are of great importance in a mold iron. The long, intertwining graphite flake form is conducive to growth in that it affords an excellent passageway for the penetration of gases. A cast iron which contains short and well-dispersed graphite flakes is in a better position to resist growth and scaling. Best results are obtained with a nickel-chromium combination than when these alloys are used separately.

The hardening effect of chromium is counterbalanced by the softening produced by nickel, and together work toward a fine-grained structure of the iron and its toughening. Molybdenum further refines the graphite and produces a flake form that is compacted and more rounded in shape. The proper use of alloying elements greatly improves the properties of a good cast iron, but it must be realized that all the alloys in the world will not correct or suitably improve an inferior cast iron that is the result of inferior metallurgical and foundry controls.

In the past 50 years, the cast-iron industry has made strides mainly in the process of improving properties of cast iron through improvements in melting and heat-treatment procedures, and by the use of alloys and inoculants. Investigators devoted considerable time and effort toward finding a single ladle addition to gray iron which would change the graphite form from flakes to some other pattern, preferably to a round shape such as that of temper carbon in malleable iron. It was felt that to accomplish this would result in overcoming some of the inherent weakness and brittleness in the flake graphite structure of cast gray iron.

In the early part of 1948, the British Cast-Iron Research Association announced that by adding the element cerium to a hypereutectic, low sulfur, low phosphorus cast iron, they produced an iron in which the graphite was in a spherical form instead of the normal flake form. At about the same time, the International Nickel Company announced the same results with the addition of an effective amount of magnesium. This American development was of greater importance because of the economies involved, and by this process nodular graphite iron could be produced from a gray cast iron of practically any chemical analysis and from any type of melting unit.

The product was formally announced to the foundry industry on February 17, 1949, under the name of ductile cast iron, and on October 25, 1949, patents were granted to the International Nickel Company on the magnesium process of producing nodular graphite cast iron. Structurally, this ductile iron is a cast, high-carbon ferrous product, free from graphite in flake form. In the cast condition, its graphite content is in the form of spheroids or nodules.

There is a marked difference between the fracture appearance of gray cast iron and the nodular iron. Gray cast iron has a dull, dark fracture, while nodular iron has a brilliant, steely appearance. Nodular graphite iron was of interest because many of the properties claimed for this new product fulfilled some of the more important requirements for glass molds.

Ductile iron does not machine as readily as other grades of normal glass mold cast irons, but it is superior to a

cast iron having equivalent transverse or tensile strengths. The Brinell hardness, after annealing, is in the range of 175 to 185. The nodular type graphite particles produces a toughness that is lacking in the brittle flake type graphite in gray iron. The cut surface tends to be smoother, with less tearing than gray iron and the machined surface resembles that of steel.

Ductile iron not only presents a fine-grained surface, but the same dense structure extends throughout the casting. This close-grained structure prevents any possibility of machining into open, porous iron in cases where mold cavities must be enlarged and reworked. It is far superior to flake type graphite iron in its ability to take a very high polish. This fine-grained structure and high surface polish is evidenced by an improved luster of the glass article.

An outstanding feature of this iron is its resistance to oxidation and growth when subjected to elevated temperatures. The shape and distribution of the graphite greatly retards penetration of oxidation which is primarily responsible for the destructive growth in ordinary iron exposed to normal glass mold operating temperatures.

The shock impact effect of hot glass upon a mold surface tends to make the surface swell or expand and the ductility of nodular graphite iron cushions and dissipates this impact, which in turn effectively reduces the possibility of cracking and heat checking. Spalling and pitting of the cavity surface is also minimized.

Ductile iron cannot be considered a cure-all for glass mold problems, but it has been used in several critical applications during the past two years, and has proved to be far superior to any alloyed cast iron previously used.

Ductile iron reaches operating temperatures much faster and runs considerably hotter than normal flake type graphite iron and this factor should be kept in mind when operating mold equipment made from this iron.

It is recommended for the following applications: (1) For two-part molds where glass article must have a high luster. (2) For long-run jobs because increased production life is indicated and less equipment changing during operation. (3) For all types of pressed ware where the prevention of cracking is of prime importance. (4) For pressed tumbler production when molds can be properly cooled.

Ductile (nodular graphite) iron is an entirely new cast ferrous product and a greater use of this new material is indicated in the near future.

One of the most recent alloy applications to glass mold iron and which is being tested widely in the glass industry with enthusiasm and encouraging results in Colmonoy, a hard-facing alloy consisting of nickel-chromium and boron. It is applied by a powder metal spraying process and fused to the base material to provide a non-porous, fusion bonded, wear- and heat-resistant surface up to 0.060 in. thick. The prolonged life of spray welded hard-faced alloy irons has provided longer continuous operation for glass container manufacturing equipment. Container quality has been further improved by this alloy application because the iron retains a smoother surface for long periods.

The Colmonoy alloy has high resistance to oxidation at elevated temperatures, as well as remarkable metal-wetting properties. It also has what is known as a high plastic range. This means that the alloy is plastic or "mushy" over a wide range of temperatures (1850° to 2050°F.), enabling it to be bonded to steels, stainless steels, nickel alloys, cast irons and some copper alloys without flowing or losing its shape.

Rockwell hardness is 56 to 62 with exceptional resistance to abrasion, corrosion and galling, and absolute freedom from porosity. This material, of course, will need a long testing period in mold irons to prove its practicability, although to date the results obtained in actual practice are encouraging.

ACTIVITY AT CORNING'S HARRODSBURG PLANT

The Harrodsburg plant of Corning Glass Works has announced the successful casting and assembly of the heaviest glass windows in the world, which will be used to protect atomic plant employees working on experiments in the research and development program for an atomic powered airplane.

The windows, some of which are approximately 6 x 8½ feet in dimension and weigh as much as 12 tons, are made of high quality glass of three different densities developed last year by Corning's research laboratories. Corning is furnishing all parts for the windows under a contract which Utah Construction Company, Salt Lake City, general contractors, has for the initial portion of the Aircraft Nuclear Propulsion facility.

The windows are made up of a number of pieces of glass which are stacked together and assembled in a steel frame. After the recent demonstration at Corning, which was attended by representatives of various contractors of the Atomic Energy Commission, the windows were taken apart and are being shipped to the National Reactor Testing Station. There they will be reassembled and placed in the walls of two different rooms. The employees, by using manipulators, will thus be able to perform their experiments by looking through the huge windows without fear of radiation injury.

Also at the Harrodsburg plant, the first shipment of high quality optical glass blanks to be manufactured into 36-inch focal length lenses for aerial cameras has been made to The Perkin-Elmer Corporation. Corning officials said the shipment represents part of the largest order the company has ever received for mass produced optical glass of such precision. Specifications called for a glass of extreme homogeneity and purity.

The blanks will be ground and polished by Perkin-Elmer into lenses for a new type high-altitude photo reconnaissance camera. The $2,520,000 contract awarded the Connecticut firm is the largest production contract ever let by the Air Force for long focal-length lenses.

• Blue Ridge Glass Corporation, which sells its patterned glass products through Libbey-Owens-Ford Glass Company, was recently presented with an "award of merit" for the excellence of its Securit glass door advertising. The competition, sponsored by Associated Business Publications, judged all entries on the objectives of the ads, their coherence, quality of illustrations, typography, copy, use of color, product application and correlation.

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during March 1954 was as follows: *Flat Glass:* 25,300 persons were employed during March according to preliminary reports. This is a drop of 3.4 per cent from the adjusted figure of 26,200 reported for February. *Glass and Glassware, Pressed and Blown:* A preliminary figure of 78,200 was reported for March, indicating a rise of .7 per cent over the adjusted February employment figure of 77,600. *Glass Products Made of Purchased Glass:* During March, employment was a preliminary 14,000. This is 1.4 per cent less than the adjusted 14,200 reported for February.

Payrolls during March 1954 were: *Flat Glass:* A preliminary $10,551,112 was paid out by glass manufacturers during March. Compared with the previous month's adjusted $11,385,123, a drop of 7.3 per cent is shown. *Glass and Glassware, Pressed and Blown:* During March, a preliminary $23,886,711 was reported. This is 1.3 per cent higher than the adjusted $23,568,931 paid out during February. *Glass Prdoucts Made of Purchased Glass:* Preliminary payrolls during March were $3,609,667. Compared with February's adjusted payrolls of $3,688,308, a drop of 2.1 per cent is shown.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

	April, 1954
Narrow Neck Containers	
Foods	1,144,000
Medicinal & Health Supplies	885,000
Chemicals, Household & Industrial	706,000
Beverages, Returnable	682,000
Beverages, Non-returnable	92,000
Beer, Returnable	207,000
Beer, Non-returnable	585,000
Liquors	585,000
Wines	325,000
Toiletries & Cosmetics	491,000
Sub-total (Narrow)	5,702,000
Wide Mouth Containers	
Foods	*2,347,000
Dairy Products	193,000
Medicinal & Health Supplies	289,000
Chemicals, Household & Industrial	187,000
Toiletries & Cosmetics	144,000
Packers' Tumblers	172,000
Sub-total (Wide)	3,332,000
Total Domestic	9,034,000
Export Shipments	241,000
TOTAL SHIPMENTS	9,275,000

* This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production April 1954	Stocks April 1954
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,564,000	3,862,000
	Wide Mouth	*3,603,000	*4,192,000
Dairy Products		200,000	315,000
Beverages, Returnable		807,000	1,533,000
Beverages, Non-returnable		103,000	184,000
Beer, Returnable		272,000	522,000
Beer, Non-returnable		616,000	941,000
Liquors		740,000	945,000
Wines		377,000	410,000
Packers' Tumblers		178,000	195,000
TOTAL		10,460,000	13,099,000

* This figure includes Fruit Jars and Jelly Glasses.

Glass container production, based on figures released by the Bureau of Census, was reported to be 10,460,000 gross during the month of April 1954. When compared with March production of 11,200,000 gross, a drop of 6.6 per cent is indicated. During April 1953, production was 10,290,720 gross, or 1.6 per cent below April this year. At the end of the January-April 1954 period, glass container manufacturers have produced a total of 41,225,616 gross. This is 4.9 per cent ahead of the 39,280,571 gross produced during the corresponding period in 1953.

Shipments of glass containers fell off during April to reach 9,275,000 gross. This is 23.5 per cent below the 12,134,000 gross shipped during March, which shipments were the second highest made by the industry during a single month. During April 1953, shipments were 9,442,688 gross, or 1.7 per cent higher than for April this year. At the end of the first four months of 1954, shipments of glass containers have reached a total of 38,829,195 gross. This is 1 per cent behind the same period of 1953 when shipments were 39,242,892 gross.

Stocks on hand at the end of April 1954 were 13,099,000 gross. This is 9.2 per cent higher than the 11,991,000 gross on hand at the end of March 1954 and 34.4 per cent higher than the 9,740,640 gross on hand at the end of April 1953.

Automatic tumbler production during April 1954 rose only slightly to reach 6,074,989 dozens. This is .1 per cent higher than the 6,067,264 dozens produced during March. Production during April 1953 was 6,028,661 dozens. Shipments during April 1954 were 6,151,542 dozens. This is an increase of 8.7 per cent over the previous month's shipments of 5,654,414 dozens. Shipments during April 1953 were 5,885,676 dozens. Stocks on hand at the close of April 1954 were 9,852,150 dozens, or 4 per cent under March stocks of 10,272,027 dozens. At the end of April 1953, stocks were 10,581,964 dozens.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during April 1954 were 3,148,476 dozens. This is a drop of 17.1 per cent from the previous month's sales of 3,801,773 dozens. Sales during April 1953 were 3,549,110 dozens. At the end of the 12-month period ending April 1954, manufacturers had sold a total of 38,063,761 dozens. This is 9.1 per cent under the 41,878,297 dozens sold during the corresponding period in 1953.

KARL TURK, PEMCO CHAIRMAN, DIES

The death of Karl Turk, co-founder and Chairman of the Board of Pemco Corporation, followed an illness of two months. He was 72 years of age.

Born in Germany, Mr. Turk came to this country about 52 years ago. Since 1903, he was active in the development of modern porcelain enameling. For seven years, he worked in an enameling plant during the day, learning the problems which confronted the manufacturer of porcelain enameled signs of the early 1900's. At night, under the glaring light of a Welsbach burner, he tested formulas and sought by trial and error to learn the means by which porcelain enamel could be made available to manufacturers on a practical basis. In 1910, Mr. Turk organized The Porcelain Enamel and Manufacturing Company, introducing a wet-process cast-iron enamel making greater production an immediate possibility. In order to extend the use of the new enamel, Mr. Turk and his brother, the late Heinrich Turk, supervised the installation and furnished the equipment for the first enameling plant in a private factory.

Mr. Turk continued his researches and activity in the development of the field he knew so well. His pioneering created many "firsts" for the industry as a whole, as well as for his own company. He is the author of one of the most simple, practical and useful publications dealing with porcelain enamel. Soon after he began manufacturing commercial frits, he published from time to time pamphlets and leaflets dealing with the problems which confronted enamelers.

Growing up in the firm have been three sons, Richard, Herbert and Karl Turk, Jr., all officers of the corporation. Besides the sons, survivors are his wife, Margaret; a sister, Mrs. H. O. Wienhold; and three daughters, Mrs. Ralph Eden of Atlanta, Ga.; Mrs. Alvin Klein of Street, Maryland; and Mrs. Jay Zeren of Baltimore.

NEW DIAMOND TOOL FIRM ESTABLISHED

The formation of Diamond Tool Associates, a new concern which will manufacture and distribute a complete line of diamond abrasive cut-off blades, has been announced by John F. Martyr, Sales Manager and Partner.

Located in Hawthorne, California, the new concern is now completing installation of tooling and will shortly be in full production. A full line of diamond core drills will also be manufactured. According to Mr. Martyr, the new company will make available an extensive series of diamond core drills and diamond abrasive cut-off blades under the name of Boart Tools.

• Creation of a new company in Japan for the manufacture of glassed-steel and alloy equipment has been announced by Pfaudler Company. The new firm, Shinko-Pfaudler Company, Ltd., of Kobe, Japan, will be operated jointly by Pfaudler and Kobe Steel Works, Ltd. It will start operations within the next six months.

BALL NAMES PLANT MANAGER

Ball Brothers Company has announced the appointment of Harold L. Maranda, formerly of the Owens-Illinois Glass Company, as Plant Manager for their glass container manufacturing in Muncie.

Mr. Maranda will be responsible for the direction and coordination of all production activities at the Muncie operation, according to an announcement by Robert W. Biggs, Vice President in charge of Glass Manufacturing.

The new Ball Plant Manager was with Owens-Illinois from 1925 to 1952. He was a chemist and then an accountant at their Streator, Illinois, plant. In 1934, he was transferred to the Owens-Illinois operation at Charleston, West Virginia. Later, he was named Charleston Plant Manager and in 1946 was advanced to the Streator plant managership. He resigned from the latter assignment in 1952 and had been engaged in a private enterprise since then.

STIG LINDROTH JOINS GENERAL ELECTRIC

The Glass Technology Laboratory of the Lamp Division of the General Electric Company has announced that Stig Lindroth has joined that organization. Mr. Lindroth comes to this country from the Surte Glass Works, Surte, Sweden, where he had been head of the development laboratory for the past five years. In his new position, he will be concerned with research on glass as used in lighting applications.

Mr. Lindroth is a native of Sweden where he received his B.S. and M.S. degrees from the University of Uppsala. During 1947-48, he attended the University of Illinois where he received a M.S. degree in ceramic engineering. In addition to his degree work, he has also had additional work under Dr. A. Dietzel and Dr. J. A. Hedvall. He has been active in the International Commission on Glass and was co-founder and President of the Scandinavian Society of Glass Technology. He was honored in 1949 as the recipient of the S. B. Meyer, Jr., Award of the American Ceramic Society, Glass Division, for his paper on "Study of Glass Batch Melting with Radioactive Tracing".

STAUFFER ELECTS BOARD CHAIRMAN

The Board of Directors of the Stauffer Chemical Company has announced the election of Christian de Guigne to the new position of Chairman of the Board. Mr. de Guigne has been President for the past 8 years.

Hans Stauffer, formerly Executive Vice President and General Manager, was elected President, following 34 years of service with the company. John Stauffer, Vice President and Secretary, with 36 years of service, has taken on the added responsibilities of Chairman of the new Executive Committee.

New Equipment and Supplies

BUTTON STEM ANNEALING OVEN

Steiner-Ives Company, 333 Springfield Road, Union, New Jersey, has developed a new annealing oven to reduce heat strain in cathode ray tube button stems. This oven holds the stems in a vertical position during the heating process, is of a conveyor type and has three heat zones, each of which can be controlled separately or as a unit to provide the proper heat curve.

Speed of operation can be varied by means of variable rheostat controls and the electronic pyrometer-type controls hold the temperature variance to a minimum. Hourly production of annealed stems is about 300. The new oven, which is designated as Oven K-1, reduces shrinkage, practically eliminates spoilage from non-uniform heating and improves the quality of the stem. The length of the oven is 6 feet, not including the conveyor extensions, with a 3-zone, 36″ heating area followed by a 36″ gradual cooling chamber. The oven is electrically heated by elements in the side walls and it is fully insulated for maximum uniformity and minimum heat loss. Other sizes of ovens are available and variations to meet special conditions and requirements can be provided for.

NEW 4-WAY VALVE

Airmatic Valve, Inc., 7317 Associate Avenue, Cleveland 9, Ohio, has announced a new hand-and-foot operated four-way valve with patented built-in, full-capacity, flow control meters of the Venturi type. An air and low-pressure hydraulic valve was specially designed for the control of double acting air or hydraulic cylinders.

The valves are ruggedly built for heavy-duty service and long operating life, featuring one balanced spool using renewable "O" ring type of packing. The flow control meters permit full-line volume without loss of pressure. Line pressure variation will not affect valve function.

The basic valve is also available for remote pilot operation, cam, single or double solenoid, together with time-delay features.

NEW WARREN SPECTRACORD

Fisher Scientific Company, 717 Forbes Street, Pittsburgh 19, Pa., has announced the development of the new Warren Spectracord which is a spectrophotometer records using the tried-and-proved Beckman DU Spectrophotometer as a monochromator.

In addition to absorption spectra, it records the visible and ultraviolet emission spectrum of any source—hence, it handles flame spectra, gas discharge, fluorescence. An adjustment expands the curve horizontally, spreading out sharp peaks and revealing fine detail. It can be started or stopped at any wavelength, the speed can be changed without stopping, and it can be made to back up and start again at any point. The transmittance scale is visable at all times on the control panel and a pointer shows the position of the pen. The wavelength setting and slit adjustment of the monochromator appear through windows.

The Spectracord operates normally in two ranges: the visible spectrum from 350 to 750 millimocrons, or the ultraviolet range from 215 to 375 mu. It is easily adjusted to cover other ranges, with or without expansion, between 200 and 750 mu.

DIAMOND IMPREGNATED DRILLS

Diamond Products, Inc., 358 Prospect Avenue, Elyria, Ohio, has introduced a new line of diamond impregnated drills for both laboratory use and production line techniques. These tools are used for drilling glass, quartz, china, marble, etc.

Many small diamonds are distributed throughout a matrix of tungsten carbide or molybdenum. As the bit wears through use, new diamonds are constantly being exposed to provide long, satisfactory service. The matrix is entirely used up in the drilling process and no re-setting of the diamonds is necessary, resulting in more economical operating cost. Specific material to be drilled determines the size and setting of the diamonds.

QUALITY CONTROL FLUOROSCOPE

J. W. Dice Company, Englewood, New Jersey, has developed a new Adrian "QC" (Quality Control) fluoroscope for visual X-ray inspection of many parts and materials.

The new inspection device loads from the front and can be supplied with a push-button control for rapid opening and closing of the hood. Fluoroscopic screen size of the standard model is 16″ x 23″ and the inspection area is 18½″ x 26″. A Class "A" cabinet affords complete operator protection.

CATALOGS RECEIVED

Harbison-Walker Refractories Company, Farmers Bank Building, Pittsburgh 22, Pa., has issued two new bulletins—one featuring Coleman XX for high-duty service and Coleman for intermediate duty service; the other featuring Alamo and Varnon superduty fireclay brick.

The first 8-page bulletin, in addition to descriptive details, includes charts showing spalling resistance, the results of load tests and thermal expansion. A section is devoted to several other products stocked at Harbison-Walker's Athens plant.

The brochure featuring Alamo and Varnon includes technical details, application information and a variety of charts which indicate such properties as refractoriness, porosity, linear subsidence, alumina content and the relative load in the panel spalling test.

American Wheelabrator & Equipment Corporation, 1026 South Byrkit Street, Mishawaka, Indiana, is distributing a new catalog describing its line of air-blast cleaning nozzles. Three standard models of nozzles are described, as well as information on pressure blast hose fittings for standard nozzles.

Of special interest to cleaning engineers is the description of materials employed in the nozzles, and the discussion of how to control compressed air consumption. This is accompanied by tabular data showing the importance of controlling nozzle wear.

Leeds & Northrup Company, Advertising Division, 3907 Stenton Avenue, Philadelphia 44, Pa., has published a new catalog describing "pH Electrodes and Electrodes for Measuring Redox Potentials—Assemblies, Parts and Accessories."

The book covers the complete Leeds & Northrup electrode line, chemicals for electrode servicing, and auxiliary electrode equipment such as clamps, holders, thermometers. Primarily, however, it is designed to present electrode assemblies for measurement, recording and/or control of solution pH and redox potentials, and should be of major interest to production and research men engaged in this work.

Minneapolis-Honeywell Regulator Company, Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa., has issued two new catalogs.

Catalog 9301 covers the four types of radiamatic radiation detectors for measuring temperatures from 125 to 7000°F. General specifications are included for the general purpose, the small target, the miniature and the low range radiamatic radiation detectors, their accessories, and ElectroniK instruments and millivoltmeter pyrometers for use with these radiation detectors. The catalog also contains several typical applications of this equipment.

Data Sheet 10.0-17 describes a new ElectroniK recorder for the automatic plotting on a single chart of a curve that continuously evaluates two variables in terms of a third. The new instrument incorporates three complete measuring and balancing circuits that can be energized by any d-c millivolt source. Expressed mathematically, the duplex function plotter continuously plots x, $x' = f(y)$.

Keep your production of Incandescent Lamps, Fluorescent and Electronic Tubes at its peak with

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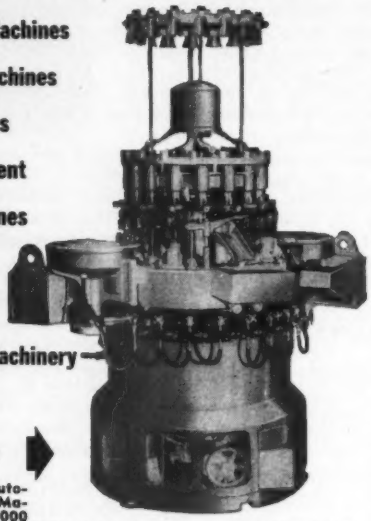
Automatic Glass Machines . .

★ Hot Cut Flare Machines
★ Cold Cut-off Machines
★ Sealing Machines
★ Exhaust Equipment
★ Finishing Machines
★ Glass Lathes
★ Stem Machines
★ Special Glass Machinery



Illustrated at right—Automatic Hot Cut Flare Machine with capacity of 3000 to 4000 pieces per hour. Universal upper chucks accommodate No. 27 to No. 44 tubing. Micrometer adjustments for cutter and flaring tool.

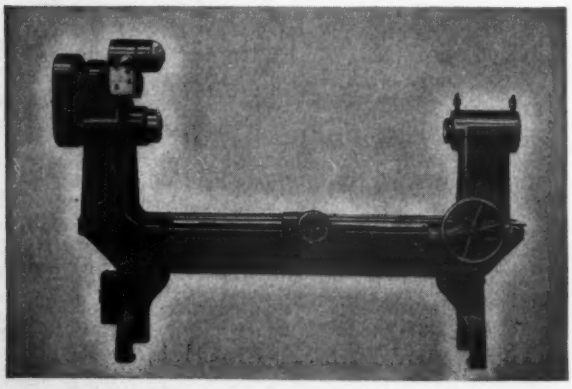
● Standard Tool engineers are specialists in the design and manufacture of automatic machines for all types of incandescent lamps, fluorescent, electronic and cathode ray tubes. Over 40 years experience in the glass field, plus precision manufacturing refinements assure you of equipment that will exceed your production expectations. A competent engineering staff is available for consultation at your convenience. Standard Tool machines have been production-proven over many years!

Creative Machine Designers & Builders

STANDARD TOOL & MANUFACTURING CO.

235 LAUREL AVENUE
ARLINGTON, NEW JERSEY

Illustrated below—3" Spindle Glass Lathe designed for television tube production —— 75" maximum distance spindle to spindle and 44" diameter swing. Has high ratio spindle length to spindle diameter and tapered spindle bearings. Incorporates hand scraped ways and integral variable speed drive.



INVENTIONS AND INVENTORS . . .
(*Continued from page* 324)

of which bands of shallow scratches are made in a glass surface to form precisely located calibration marks. The scratches are of a minimum cut provided by a diamond or a similar tool.

This apparatus includes means which enable an operator to precisely align a scratching tool with a selected zero point on the surface of a receptacle, a means for at will precisely moving the supported work with respect to the scratching tool and means for supporting and guiding the work with respect to a scratching tool. The method is said to be superior to previously used etching methods.

The patent contains three claims and the following references were cited: 278,845, Atwater, June 5, 1883; 1,624,549, Halvorsen, Apr. 12, 1927; and 564,111, Great Britain, Sept. 13, 1944.

Miscellaneous Processes

Application of Reflective Coatings by Thermal Vaporization. Fig. 6. Patent No. 2,665,659. Filed April 24, 1952. Issued January 12, 1954. Three sheets of drawings. Assigned to Libbey-Owens-Ford Glass Company by James C. Ogle, Jr.

This invention relates to apparatus for transporting and coating articles such as glass prisms by thermal evaporation. The apparatus of Fig. 6 comprises base 40 upon which a dome-like casing, housing or bell 41 is supported or fitted to close the chamber, thus providing a chamber 42 within which thermal evaporation operations may be carried out. A pipe or conduit 43 is in communication with the interior of the chamber and with high-speed suction pumps for withdrawing air from the chamber to create a vacuum. The article-supporting racks A carrying articles P are arranged in spaced relationship adjacent the upright walls of the chamber, along the periphery of a circle.

A sprocket chain 52 is in engagement with each of the sprockets 50 and is connected, by virtue of suitable gearing, shown as a whole at 53, with a prime mover including a preferably brushless type electric motor M mounted upon the base 40. Thus, by operating the electric motor, the sprocket chain is driven to revolve or rotate, simultaneously, all of the sprockets 50 which, in turn, will cause the article-carrying racks A, which are supported by the sprockets, to be likewise turned or revolved, simultaneously. After the coatings are completed, the racks A are preferably removed from the dolly or portable cart and a new supply of prisms are set up for coating.

The patent contains 10 claims and the following references were given: 2,260,471, McLeod, Oct. 28, 1941; 2,369,764, Ullrich, Feb. 20, 1945; 2,414,406, Colbert et al., Jan. 14, 1947; 2,453,801, Mattern, Nov. 16, 1948; 2,475,854, Ogle, July 12, 1949; and 2,522,272, Johnson et al., Sept. 12, 1950.

Light Directing Glass Block. Fig. 7. Patent No. 2,665,610. Filed November 10, 1949. Issued January 12, 1954. One sheet of drawings. Assigned to Holophane Company, Inc. by Ward Harrison.

This invention relates to improvements in glass blocks, in which the sides of the block embody internal hori-

(*Continued on page* 332)

OPERATING DATA		
GLASS	Flint Container Glass	
LIFE	Operating Days	996-¾
SIZE	601 Square Feet of Melting Area	
PULL	Total Tons Glass Melted	93,389
	Square Feet Melting Area Per Ton of Glass Per Operating Days	6.41
	Tons of Glass Per Square Foot of Melting Area Per Life	155.39
	Average Tons of Glass Per Operating Day	93.69
FUEL	Natural Gas	
	TON 2000 LBS.	

HERE'S WHERE THE PAVEMENT ENDS

This performance record on the Walsh Mulliflux "B" bottom blocks in a glass melting furnace of one of the larger container manufacturers in the industry—*speaks for itself!*

And had it not been necessary to replace refractories other than that manufactured by Walsh, both the customer and Walsh engineers are in agreement that the Walsh bottom would have given an additional year or more service. Specifically, at the conclusion of 996 days of continuous operation, the thickness of the bottom ranged from a minimum of 4½" up to 7".

Yes, the evidence is continuing to pile up that premium quality Walsh Mulliflux "B", vacuum cast blocks for glass furnace bottoms are the last word in dependability and economy. As a result, more and more progressive operators have discovered the money-saving answers to the question:

Mulliflux, Vacuum Cast Sidewall and Bottom Blocks; Cast Sillimanite Refractory for Upper Structure; Mullitex and Mullitex HB Fire Brick and other refractories for the glass industry.

Why pave . . . when you can save—with Mulliflux Bottom Blocks?

We'll welcome an opportunity to explore the possibilities with you for the advantageous use of Walsh Mulliflux in *your* furnaces. Call or write today.

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FOR OVER 50 YEARS MANUFACTURERS OF HIGH GRADE REFRACTORIES

fact:

nothing in the world is as hard as a diamond

FACT: *in grinding glass* — metal bonded diamond wheels grind faster, at lower cost and with less spoilage than any other known method.

FACT: *in grinding carbides* — nothing cuts as fast, as cool and as economically as a diamond wheel.

FACT: *in dressing grinding wheels* only diamond dressers will do the job where fine finish, high production or intricate forms are involved.

FACT: *in lapping* — diamond compounds and powders save countless skilled man-hours by producing wanted sizes and finishes faster.

FACT: *in cutting* — diamond cutting and boring tools are standard for tough jobs where the best of competitive materials fail.

FACT: *in sawing* — diamond saw blades feature speed and economy on quartz, concrete, stone, sapphire, glass and diamond.

FACT: **Diamond Tooling gives you precise production, more production, uninterrupted production, *lowest cost production.***

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INDUSTRIAL DIAMOND ASSOCIATION OF AMERICA, Inc.

124 East 40th Street, New York 16, N. Y.

INVENTIONS AND INVENTORS . . .

(*Continued from page* 330)

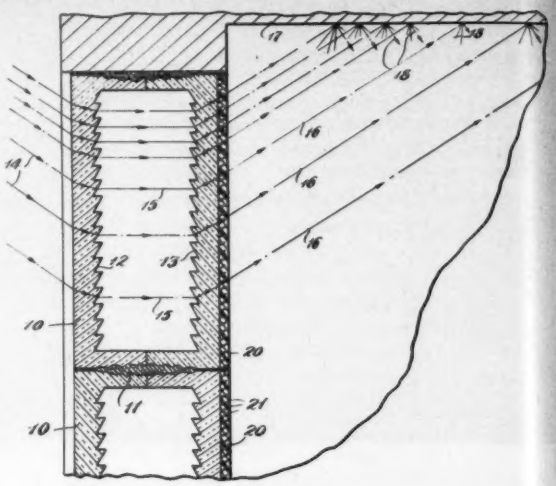


Fig. 7.

zontal prismatic flutings for deflecting incident light in a manner to cause the major part of the light to be directed through the block and then upwardly toward the ceiling of a room in an outer wall of which the blocks are incorporated. As shown in Fig. 7, the interior surfaces of the side walls of each block are formed with prismatic fittings 12 and 13, such that the incident light rays 14 directed downwardly at an angle from the sky are deflected by refraction crosswise through the block, as indicated at 15, and then upwardly through the inner wall toward the ceiling of the room as indicated at 16. The ceiling 17 is finished to reflect and diffuse light effectively, as indicated at 18.

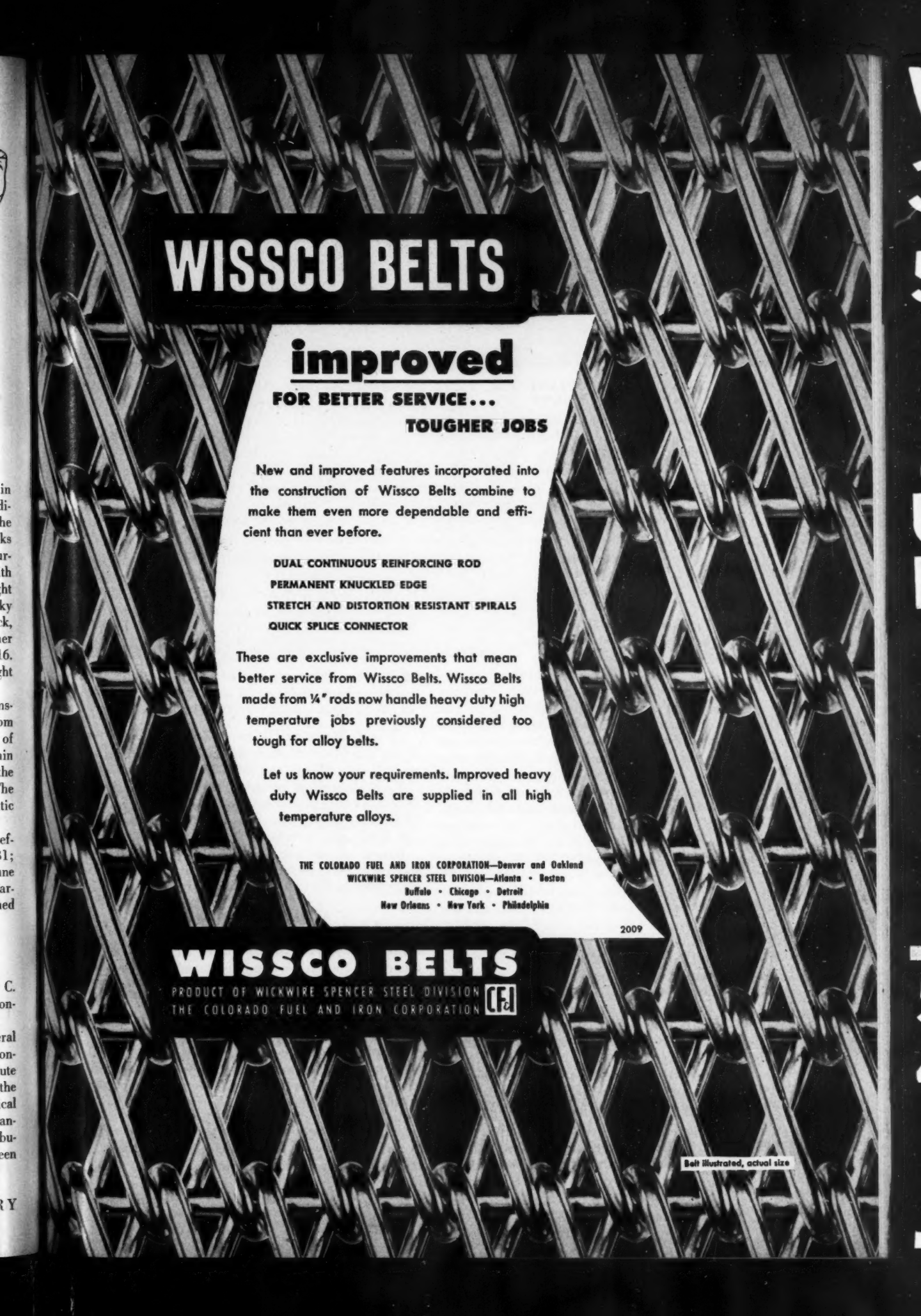
This block is used in combination with a light-transmitting louver plate 20 which is mounted on the room face of the block. This plate may be formed either of glass or of clear plastic. In order that it may be thin and therefore light in weight and inexpensive, the parallel louvers 21 are relatively closely spaced. The louver plates tend to reduce any glare from the prismatic flutings.

The patent contains 3 claims and the following references were cited: 1,811,946, Le Bailly, June 30, 1931; 2,179,863, Rolph, Nov. 14, 1939; 2,322,591, Rapp, June 22, 1943; 2,545,906, Watkins, Mar. 20, 1951; and Pearson abstract of application, Serial No. 766,579, published in O. G., November 1, 1949, vol. 628, page 256.

HARBISON-WALKER NAMES GENERAL SALES MANAGER

Announcement has been made of the appointment of C. A. Brashares as General Sales Manager of Harbison-Walker Refractories Company.

Mr. Brashares, who has served as Assistant General Sales Manager since September 1953, joined Harbison-Walker in 1928 after his graduation from Case Institute of Technology. He spent a number of years in the Research Department and then transferred to Technical Sales as a sales engineer. He became District Sales Manager in Birmingham, Alabama, in 1948. His contributions to the technical literature of the industry have been numerous and of great importance.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improved
FOR BETTER SERVICE...
TOUGHER JOBS
New and improved features incorporated into the construction of Wissco Belts combine to make them even more dependable and efficient than ever before.
DUAL CONTINUOUS REINFORCING ROD
PERMANENT KNUCKLED EDGE
STRETCH AND DISTORTION RESISTANT SPIRALS
QUICK SPLICE CONNECTOR
These are exclusive improvements that mean better service from Wissco Belts. Wissco Belts made from ¼" rods now handle heavy duty high temperature jobs previously considered too tough for alloy belts.
Let us know your requirements. Improved heavy duty Wissco Belts are supplied in all high temperature alloys.
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Buffalo • Chicago • Detroit
New Orleans • New York • Philadelphia
2009
WISSCO BELTS
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION
CFI
Belt illustrated, actual size

THATCHER COMPLETES CALIFORNIA PLANT

Completion of their new glass container plant at Saugus, California, has been announced by Thatcher Glass Manufacturing Company, Inc. The new plant has an 80-100 ton tank, equipped with Hartford-Empire I.S. machines and lehrs and currently employs 125 persons. Present production is devoted exclusively to amber containers.

Shipments from the new plant will be handled entirely by motor transport, although incoming supplies will be received from a spur off the main Southern Pacific line which runs adjacent to the plant.

As construction of their Saugus plant marks the introduction of Thatcher containers to the West Coast, the company has at the same time announced the establishment of a Pacific Coast Division with offices located at 1350 North Highland Avenue, Los Angeles. John B. Miller has been named Division Sales Manager.

CANADIAN GLASS NEWS

Canada's glass and glass products industry shipped $58,779,800 worth of products in 1952, a 7% increase over the 1951 output value of $54,913,292, the Canadian Government has just disclosed as the result of its latest annual survey of such operations.

Number of plants engaged in such operations increased again to 114 as compared with 113 in 1951, showing a steady rise in recent years from 95 in 1948, 102 in 1949, 106 in 1950. However, the number of employees dropped to 6,516 in 1952 from 66,527 in 1951, though the payroll of the workers moved up again to $19,102,882 from $17,660,204 for an 8% boost in earnings for the workers. Of the 6,516 employees, supervisors and office workers numbered 999, including 691 male and 338 female, and 5,487 production workers, including 4,688 male and 799 female. Earnings included $3,445,478 supervisory and office workers pay as well as $15,657,404 production workers.

Cost of fuel and electricity at works advanced 9.9% from $3,542,633 in 1951 to $3,892,431 in 1952, and cost of material at works reached $22,192,757 against $20,551,774 for a gain of 8%.

Ontario and Quebec again accounted for the bulk of production in the glass and glass products industry in 1952, with Ontario showing 59 plants and output worth $33,309,831 as against preceding year's 61 plants with output of $30,319,273, and Quebec showing 36 plants with an output of $20,072,421 compared with 33 plants and production of $19,787,780.

Products made in the industry included the following in 1952 (selling value at works), figures in brackets representing output in the preceding year:

Cut and Bevelled Glass Division: Mirrors: Plate Glass, $2,929,590 ($2,760,559), Sheet Glass, $810,985 ($816,107); Other Products of Glass Bevelled or Polished Edge Plate, $1,050,243 ($996,416), Bevelled or Polished Edge Sheet Glass, $313,510 ($360,229), Leaded Glass, including Memorial Windows, $232,521 ($236,376); Cut glass, such as tumblers, bowls, etc., $889,428 ($813,176), Decorated glassware, including engraved, etched, sandblasted applied color, etc., $189,975 ($362,386), Druggists', physicians' and laboratory glassware, $484,433 ($549,148), Other glass products, $13,458,635 ($10,936,440); Receipts for repair work, $99,827 ($146,926); All other products, $819,194 ($926,324).

Pressed, Blown and Drawn Glass Division: Pressed, Blown and Drawn Glass, including Bottles, Sealers, Ovenware, Window Glass, etc., $37,501,459 ($36,009,205).

Materials used in manufacturing operations included $9,576,212 for cut and bevelled glass in 1952 as against $8,172,111 in 1951 and $12,616,545 for pressed, blown and drawn glass as compared with $12,379,663.

Imports of glass and glassware dropped to $26,847,638 in 1952 as compared with $31,408,091 in 1951 and such exports fell to $521,837 as against $970,031.

ACHESON INDUSTRIES ADDS TO STAFF

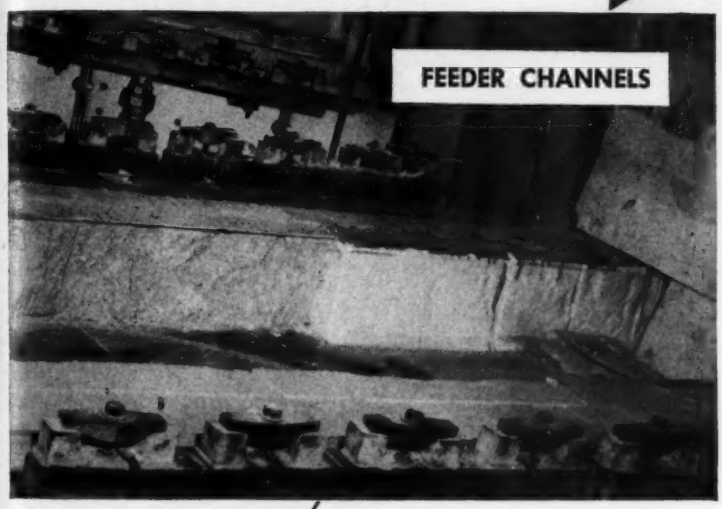
Howard A. Acheson, Jr. has joined the staff of Acheson Industries, Inc. as assistant to Raymond Szymanowitz, Executive Vice President. Mr. Acheson will be located at the company's Newark, New Jersey, offices.

After graduation from Cornell University in 1951 with a B. Ch. E., Mr. Acheson became associated with Esso Standard Oil Company at its Bayway Refinery. Following a tour of duty with the U. S. Army as a 1st Lieutenant, Ordnace, he returned to Esso for a year prior to joining Acheson.

• Russell J. O'Neil has been appointed a field engineer by Norton Company for the Detroit district office. Mr. O'Neil has been with Norton since 1945.

The trend is to MONOFRAX®

FUSED CAST
refractories



YOU CAN SEE THE DIFFERENCE between these two types of feeder-channel blocks. This is after three years on flint bottle glass. The clean, smooth blocks next to the tank entrance are MONOFRAX MH fused cast refractories. Though this is the hottest, most corrosive part of the channel, there are no signs of pitting or grooving. In contrast, the other material is pitted and grooved badly and shows evidence of considerable joint attack. The spongy appearance of the blocks indicates a probable source of stones or cords in the glass.

This plant now has on order, or is in the process of installing, 18 complete feeder channels using MONOFRAX MH blocks right up to the bowls. It is anticipated that glass quality will improve and that block life will be extended — possibly to two full campaigns. With this longer service, the savings in cover blocks alone may amount to several thousand dollars per channel. Does this sound worth investigating?

FOUR MORE SETS of MONOFRAX MH feeder channel blocks have just been ordered by a flint container producer who already has two sets in service. Judging from previous experience, he anticipates that these MH blocks will improve glass quality and give longest refractory life.

CARBORUNDUM
Registered Trade Mark
Dept. L-64, Refractories Division
The Carborundum Company, Perth Amboy, N. J.

M.I.T. SUMMER PROGRAM IN HIGH TEMPERATURE CERAMICS

The Massachusetts Institute of Technology has announced a two-week Special Summer Program in High Temperature Ceramics from July 19 through July 30. The program is designed for teachers, research workers and development engineers concerned with the application, development and properties of ceramic materials at high temperatures. Its object is to present recent developments in techniques and results of high-temperature measurements, properties of ceramic materials at high temperatures and applications of both academic and developmental interest.

The Special Summer Program will comprise lectures, discussions and laboratory experiments, and will be under the direct supervision of Dr. F. H. Norton, Professor of Ceramics, and Dr. W. D. Kingery, Assistant Professor of Ceramics, assisted by other M.I.T. staff members and guest lecturers.

CORNING SUGGESTION AWARD

The award of $9,653 to two Albion, Michigan, men has been announced as the largest single amount ever earned through the Corning Glass Works suggestion system. Stanley B. Morgan and John H. Hess split the money for their suggestion concerning an improved method of freeing glass television funnels from their molds. Both men had previously cashed in on ideas through the company suggestion system, Mr. Morgan collecting $959 for 24 different proposals and Mr. Hess receiving $452 for seven suggestions.

LACLEDE-CHRISTY ELECTIONS

At the Annual Meeting of Stockholders of Laclede-Christy Company, the following directors were elected: Wm. H. Armstrong, Herbert F. Boettler, J. LeBeau Christy, Walter W. Shipley, J. D. Streett, Erwin P. Stupp and J. Gates Williams.

At the Annual Meeting of Directors held on the same day, the following officers were elected: J. D. Streett, President; L. C. Hewitt, Vice President; Walter W. Shipley, Vice President and Treasurer; E. J. Williams, Controller and Secretary; and J. H. Schoemaker, Assistant Secretary and Treasurer.

FERRO PURCHASES LOUTHAN

R. A. Weaver, Chairman of the Board of Ferro Corporation, has announced the purchase of the Louthan Manufacturing Company of East Liverpool, Ohio, from Harbison-Walker Refractories Company, a transaction which was approved by the Ferro Board of Directors at their April 30 meeting.

Harry T. Marks, Administrative Vice President of Ferro, will be the new President of the Louthan Division of Ferro, according to Mr. Weaver, and Charles W. Gerster will be Executive Vice President and General Manager. Other officers include George E. Weber, Secretary and Treasurer, and George Beck, Jr., Assistant Secretary and Treasurer.

The new Louthan Division will produce electrical porcelain insulators, refractory specialities for firing pottery and for the foundry field, and other ceramic products.

reminder

reminder

reminder

Stauffer CHEMICALS SINCE 1885

As little as 1% of F. W. Smith Brand Borax added to soda-lime glass speeds up production and increases the mechanical and thermal strength of the glass.

BORAX

Anhydrous, Pentahydrate and Decahydrate
Technical & U.S.P. Grades
Boric Acid · Nitrate of Potash
Sulphurs

STAUFFER CHEMICAL COMPANY

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824 Wilshire Blvd., Los Angeles 14, Calif. • 636 California Street, San Francisco 8, Calif.
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Users of Drakenfeld Colors know the economic value of high standards that prescribe strict control of color formulation and manufacture on initial and all subsequent orders. In color research as in color production, our broad experience and modern facilities help them reduce costs and maintain product quality. If you haven't experienced the satisfaction of Drakenfeld cooperation, we welcome the opportunity to demonstrate our ability to be of money-saving service to you. Your inquiry will receive prompt attention.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Silver Paste . . . Crystal Ices . . . Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Glassmakers' Chemicals . . . Glass Decolorizers . . . Glass Frosting Compounds . . . Decorating Supplies.

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UR PARTNER IN SOLVING COLOR PROBLEMS

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BRAUN CORPORATION, 2260 East Fifteenth Street
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CORNING ORGANIZATION CHANGES

Two organization changes in the Research and Development Division of Corning Glass Works, and one in the company's Technical Products Division, have been announced by Corning President, William C. Decker.

In the Research Laboratory, Dr. William W. Shaver was appointed to head up the newly-established Atomic Energy Department, and Dr. John L. Sheldon was appointed Manager of the Television Department. In the Technical Products Division, J. S. Chowning was named to handle the commercial sales of glasses for nuclear energy applications.

The Atomic Energy Department has been established to intensify and expand Corning's development and application of special glasses and glass products required by the atomic energy program. In his new position, Dr. Shaver will work closely with government and industrial research laboratories, electric utility companies and industrial manufacturers engaged in exploring new applications of atomic energy for peacetime purposes.

The Television Department, under Dr. Sheldon, is responsible for the further development and expansion of Corning's television program, with particular emphasis on developmental work in the color field.

In his new position, Mr. Chowning will handle the commercial sales of glasses already available or under development for application in the facilities of the Atomic Energy Commission and industrial firms and universities working with nuclear energy. He will also act as liaison between the Corning research and development laboratory and A.E.C. facilities.

Dr. Shaver earned his Bachelor of Arts, Master of Arts and Doctor of Philosophy degrees at the University of Toronto, and served for a year as a research assistant on the University staff. He joined Corning in 1924 as a physicist in charge of the company's Insulation Division. In 1931, he was transferred to the physical laboratory, and at the time of his new appointment was Manager of Product Development.

Dr. Sheldon joined Corning in 1940 as a research chemist, later advancing to senior research associate. He has been closely associated with the expansion and development of Corning's television program. Dr. Sheldon received his Bachelor of Science degree at Battle Creek College and his master's and doctor's degrees at the University of Michigan.

A chemical engineer, Mr. Chowning became associated with Corning in 1936 as a member of the Works Control Laboratory staff. He was closely connected with the development of glass pipe and pipe hardware and with Multiform processing. He served for a time as a sales engineer in the Industrial Sales Department, and in 1950 was named Manager of Plant Equipment Sales, continuing in that capacity until 1953 when he assumed the post of staff engineer for Standard Products Sales.

• L. A. Jarvis has been named technical service representative of the calcium carbonate department, Wyandotte Chemicals Corporation, Michigan Alkali Division, it has been announced. Mr. Jarvis is a graduate of Michigan State College where he majored in chemistry and joined the Wyandotte firm in 1949.

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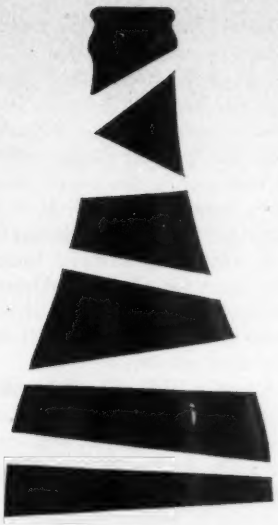

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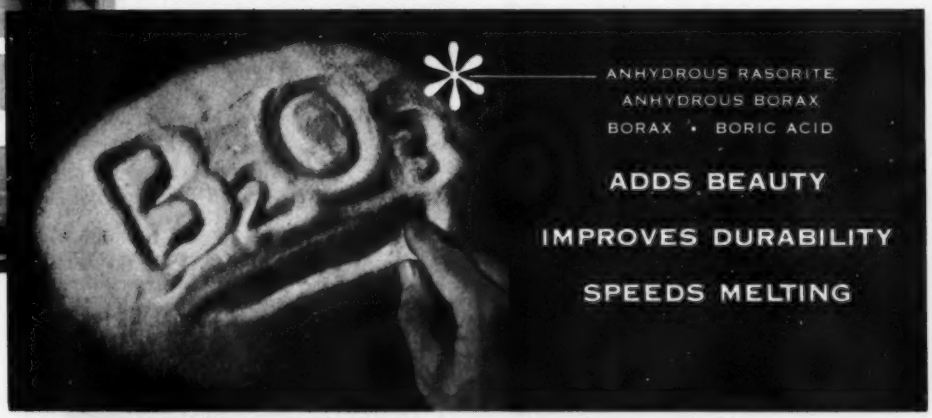

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RADIOACTIVE TRACERS . . .
(*Continued from page* 313)

the rouge remained sensibly constant from the beginning of the operation. It appears that there was no accumulation of glass in the slurry.

Therefore, the polishing process appeared as beginning from the abrasive phase which contributes to the formation of a layer of glass in a particular state of activity on the polisher, then continues by a constant exchange of glass from the polisher and from the treated glass.

From these three examples alone, it is evident what resources tracers offer both for the technician or the inspector, as well as for the scientist. However, these methods must not be used as a cure-all. We want to repeat that the glass, labeled with radio-strontium, so easy to prepare and of an application so suitable, is not a panacea. The tagged element, which is true of Sr as well as Na, is a cation which takes part in the network structure without being a network former. In certain phenomena nothing permits saying, if such radioactivity is observed, that it is due to a like proportion of glass. It is possible to have a selection in this. For example, this is surely the case in the attack of glass by water. (We have seen that Fitzgerald, loc. cit., has correctly studied dealkalinization by labeling the alkali.) Perhaps this is the case for the last example cited. It would be interesting to tag one of the elements of the network itself, Si or O, which would permit the determination as to whether the vitreous material intervenes in a mass, so to speak macromolecularly, or whether there is a filtration of ions, ions which can even be foreign to the glass (Sr).

Unfortunately, the life time of the radioactive isotope of silicon, as well as that of oxygen, is very short. O_{15} and O_{19} have, respectively, periods of 126 and 31 seconds. The Si_{27} has 4.92 seconds. Only Si_{31} with 170 minutes permits some short experiments to be considered. Le Clerc has suggested using germanium which can serve as an indicator in silica and whose two isotopes 71 and 77 have, respectively, periods of 40 hours (emission β^+ 1.2 Mev) and 12 hours (emission β^- 1.9).

In any case, artificial radioactivity opens some new techniques for all the problems of our industry. Without doubt, in the laboratory or in the factory, there is no problem to which it may not contribute by giving an unpublished answer.

A tracer laboratory, from the time it is created, is full of problems because ideas of application appear at once. On the other hand, we will see that even if the principle is simple, its use immediately poses numerous and delicate problems.

However, without waiting further, I have had pleasure in showing that in the utilization of this up-to-date technique, the French glass workers have made a good start.

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1. Johnson, J. R. Radioactive Tracer Methods Applicable to Ceramic Research. *Am. Cer. Soc. Bull.*, 29, 1950, p. 16-19.
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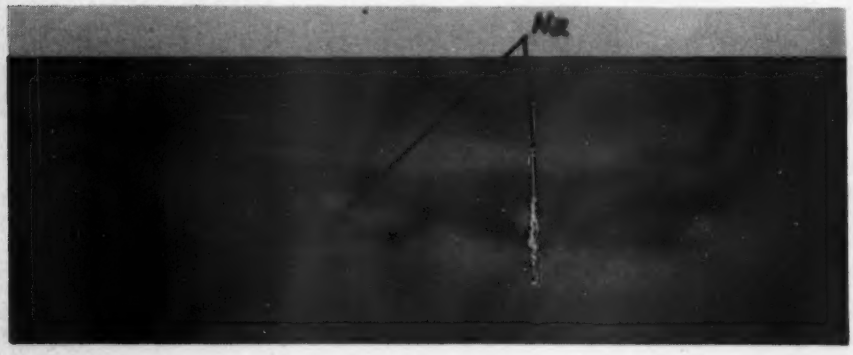
5. Blau, H. H. and Johnson, J. R. Investigation of the Glass Structure Using Radioactive Tracers. Ohio State University. *Engineering Experiment Station News* 20, 1948, p. 45-47.
6. Br. Fr. 966, 773. Comptoir d'Etirage et Profilage de Metaux.

* * * * *

Since the preparation of this article, the Glass Laboratory of Saint-Gobain has developed in several directions the applications of radio-elements. Here is a short survey of the operations which will form the object of developments in the forthcoming communications.

1—Molten glass, being an electrolyte (ionic conductor), it gives rise to all the classical phenomena of galvanic piles (battery effect): differentiated electrode pile, concentration pile, two-liquid pile, etc. . . .[1] We have placed in evidence the transportation of the Na + ions and the deep penetration of these ions, *without discharge*, in the refractory mass which serves as cathode. For this the electrode, after some hours of electrolysis in the molten glass, is exposed to the atomic pile and in the conditions of irradiation, only the sodium is activated. An auto-radiograph then shows the localization of the ions of sodium transported by the current. The photo below shows one of the radiographs obtained.



2—A sodo-calcic glass is irradiated with the atomic pile. In the conditions of experience only the sodium is activated at the moment when the glass is fused and subjected to electrolysis. The displacement of the sodium ions is studied in the electric field. The marked sodium ions of the glass are by and by replaced by unmarked nitrate sodium ions.

It is seen that a part of the sodium originally present in the glass cannot be replaced by the electrolytic displacement method. The activity diminishes to a certain limit value. One part of the sodium is not therefore under the form of free ions.

3—A radium or radio-thorium glass emits a gas emanation. With the aid of this method, the "permeability" of the structure of the annealed or tempered glass, mass or fiber form glass, etc., is studied.

1. Report of 3rd International Congress of Ceramics, May 1953, Paris.

   Report of the 3rd International Congress of Electrothermy, Section 6, No. 622, 18-23rd of May 1953, Paris.

   LE CLERC P and PEYCHES I, International Congress of Glass, Venice, July 1953, *Glass and Refractories* (Fr.) 6, 339-1953.

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Ohio Manufacturer of Container Glass and Colored Borosilicates	B&W Dense 80 and Junior Firebrick in checkers. B&W Dense 80's in burner block necks and B&W Juniors in ports.
Pennsylvania Manufacturer of Container Glass	B&W 80 Firebrick in ports, regenerator arches and walls as well as top 10 to 14 courses of checkers.
West Virginia Manufacturer of Glass for Fluorescent Lamps	B&W Junior Firebrick in checkers and ports.
Kentucky Manufacturer of Glass for Bulbs	B&W 80 Firebrick in ports, and B&W Junior Firebrick in checkers.
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PACKAGING FOR GLASSWARE

Bartlett-Collins Company has adopted protective corrugated boxes specially engineered by Hinde & Dauch for the shipping of juice sets.

The individual boxes are designed to accommodate 7-piece beverage or juice sets (six tumblers and a pitcher). Die-cut, corrugated partitions prevent the glassware from shifting in handling and transit, thereby minimizing breakage. A special self-locking bottom and a tuck-in top simplify packing operations. Six of the easy-to-assemble boxes are packed in each master unit for shipment by truck or railroad.

NORTON SETS NEW PRICING PROGRAM

Breaking a tradition of long standing in the abrasive industry, Norton Company has just instituted net pricing to make it easier to buy and sell Norton grinding wheels.

Announced by Donald L. Price, Sales Manager of the Abrasive Division, this new "net unit price program" means that a distributor or customer can determine the cost of a grinding wheel, segment, brick, stick or mounted point without resorting to former time-consuming procedures of applying multipliers to tabulated "list" prices to calculate "net" prices.

• Joseph S. McCulloch has been appointed manufacturer's representative for the Pennsylvania Salt Manufacturing Company's Corrosion Engineering Products Department, it has been announced by Robert R. Pierce, Manager.

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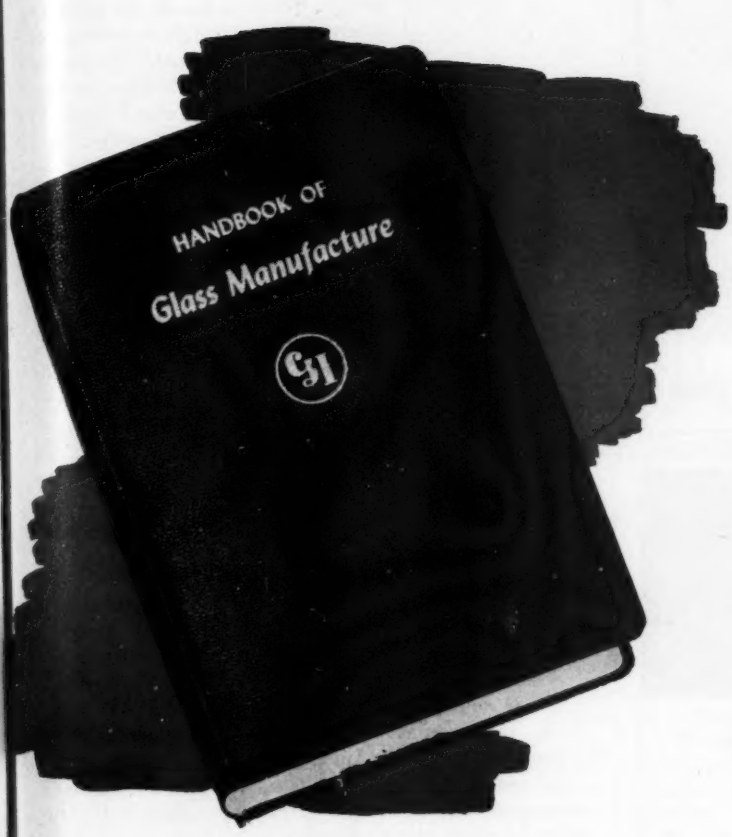

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INSTITUTE OF SILICATE RESEARCH . . .

(*Continued from page* 318)

rangements are under way to exchange students with England and Germany. A number of Fulbright scholars have already applied to the Institute for study. Thus, a study of the reactions between refractories and glass might be started by a German, continued by an American and finished by an Englishman. This was the method for research and training which proved so successful for Dr. Eitel at the Kaiser Wilhelm Institute. The association and interchange of ideas between American and foreign scientists should not only be stimulating to research but should also help to spread our democratic ideals.

The Institute of Silicate Research has as its primary goal basic research to extend our scientific knowledge of silicate substances. There are many benefits in having basic research handled by a University. Perhaps the biggest advantage is that the research work may be used to train men, both in the research method and in their field of scientific interest. Under the Institute's sponsorship arrangement, supporting companies are encouraged to pick their own men for fellowships. If the sponsor wishes, the Institute will choose the research fellow, and the company is free to observe him during his graduate training. Most basic research problems will probably extend through the training of several research fellows. These fellows will bring fresh and new ideas with their enthusiasm to solve problems, yet the continuity will be maintained by the faculty scientists. Another advantage of the industrial fellowships is that they permit competing companies to contribute to research which benefits all mankind and to a form of knowledge that is independent of trade secrets.

We were recently approached by an engineer of a large industrial concern with an applied research problem. We explained our organization to him and what we were trying to do. He thought that ours was certainly a wonderful and worthwhile venture, but that his company would never support an organization for research unless it accepted an applied problem by which a calculated return in dollars could be made for every research dollar spent. The Institute of Silicate Research is based on the notion that the large American industrial concerns are convinced, now more than ever, of the need for basic research and scientists well trained in fundamentals. Our sponsors subscribe to that belief.

BLUE RIDGE GLASS NAMES GENERAL SALES MANAGER

Richard W. Rigg, electronics sales engineer in the Electrical Products Division of Corning Glass Works, has accepted appointment as General Sales Manager of the Blue Ridge Glass Corporation, Corning associate in Kingsport, Tennessee. Mr. Rigg will leave his position with Corning to assume his new duties.

A graduate of Harvard University, Mr. Rigg joined Corning in 1946 as an industrial sales engineer. In 1948, he was appointed Manager of plant equipment sales, and in 1950, moved to the Electrical Products Division. Mr. Rigg had formerly served as assistant production control manager of the Stromberg-Carlson Radio Corporation.

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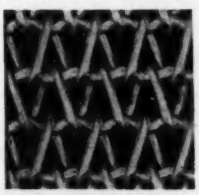
. . . of glassware. Once loaded on this Cambridge belt, ware is fired, cooled, inspected and packed in one continuous series of operations. All-metal belt is unharmed by constant operation in elevated lehr temperatures. Open mesh of the woven wire belt provides free circulation of heat and cooling air.

No newcomer to the glass industry—the science of Automation has long been employed for automatic, continuous processing of ware through annealing and decorating lehrs. And one of the important factors in this application of Automation has been the ability of Cambridge Woven Wire Conveyor Belts to withstand lehr temperatures and operating conditions for long periods without damage and without marking the ware. Other Cambridge belts in glass plants are used on feeder lines from forming machines to the lehrs, for cullet washing, mold cleaning and for general conveying.



Open mesh construction of the belt provides free circulation of process atmospheres for maximum heating efficiency and uniformity of product . . . free drainage of wash solutions or cleaning grit. Of course, the all-metal construction means lowest maintenance cost. Cambridge belts are available in any metal or alloy. Thus, the belt recommended for you can be fabricated from the specific material that will give longest belt life under your operating conditions. In addition, Cambridge belts can be woven to any length or width and in a wide variety of weaves and mesh sizes to meet your needs.

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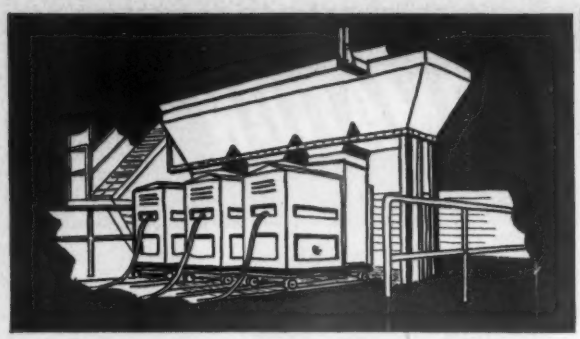

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SULPHUR IN GAS . . .

(*Continued from page* 319)

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Since pure nickel is embrittled by the hot sulphur dioxide, the gas cannot be used around this metal in lead assembly.

To insure proper working conditions, the following is to be noted:

Irritant to throat:	8-12 parts SO_2 per 1,000,000 parts air.
Max. irritant to eyes:	20 parts SO_2 per 1,000,000 parts air.
Max. long exposure:	10 parts SO_2 per 1,000,000 parts air.
To avoid trouble, keep down to:	5 parts SO_2 per 1,000,000 parts air.

This latter is not likely to be reached in a well-ventilated room. The smell is said to be carbon monoxide, not sulphur dioxide. When a machine is shut down, the sulphur dioxide must shut off.

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Allowable use for good operation—150 lb. cylinder 2#/hr.

• The Industrial Furnace Manufacturers Association will sponsor three half days to practical industrial heating sessions at the National Metals Congress and Exposition in Chicago, November 2 and 3.

• The appointment of Robert A. Jones, General Sales Manager of the Hooker Glass & Paint Mfg. Company, to the post of Assistant Vice President in charge of Sales, has been announced by Arthur A. Dole, Jr., President. In his new capacity, Mr. Jones will continue his duties as General Sales Manager.

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SITUATION WANTED

GLASS PRESSWARE PRODUCTION personnel available. Due to a planned conversion to an entirely different product, a well-known pressware manufacturer is endeavoring to place, with other manufacturers, some of their key pressware personnel. Available are men with many years experience in operation, supervision and maintenance of Lynch Presses. If interested, address Box 155, c/o The Glass Industry, 55 W. 42nd St., New York 36, N. Y.

CARDER GLASS SENT TO ALFRED UNIVERSITY

Thirty glass objects, representative of the decorative techniques developed and employed by Frederick C. Carder during his 50 years with Steuben Glass, Inc. and Corning Glass Works, have been sent to Alfred University where they will go on permanent exhibition.

Mr. Carder, founder and manager of Steuben Glass Works and retired Art Director of Corning Glass Works, presented the valuable glass collection to Alfred University during a recent visit in Corning by M. Ellis Drake, President of Alfred, and Dean John F. McMahon, of the College of Ceramics.

FOXBORO TO ERECT CALIFORNIA FACTORY

Ground has been broken for a new branch factory to be erected at 399 Preda Street, San Leandro, California, by The Foxboro Company.

Scheduled for completion by August 15, the new 8,400 square foot building will more than double the production area of the present San Francisco shop and provide increased facilities for the manufacture, sales and service of instruments and accessories.

• The Northern Ohio Section of the American Ceramic Society, in conjunction with the Canton-Alliance Engineers Club, will hold its annual Golf Outing at the Shady Hollow Club, Massillon, Ohio, on Tuesday, June 22. Tee-off time will be 12:00 noon.

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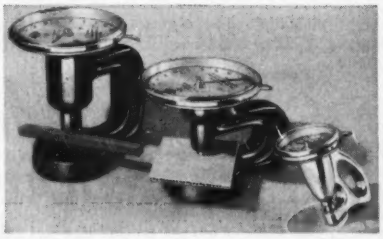

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Milestones in Glass Progress

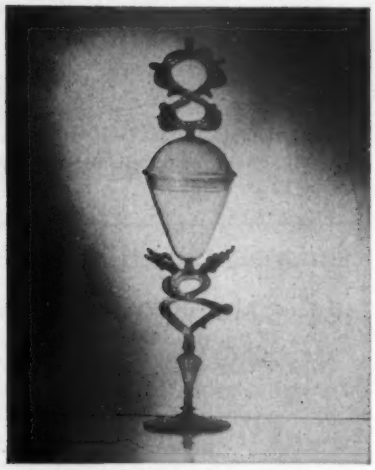

PHOTO COURTESY CORNING MUSEUM OF GLASS

1590 Early Venetian glassmakers were noted for their lavish use of decoration. Ornate goblet stems, for example, often measured 14 inches! This rare, late-16th-century Venetian covered goblet—with its dragon-shaped stem, and figure-eight finial—is so delicately made that few examples of such craftsmanship have survived.

1890 Michigan Alkali Company, now a division of Wyandotte Chemicals Corporation (South Plant, above), was founded by Captain J. B. Ford to supply Soda Ash to the glass industry. Wyandotte has grown up with glass. Today, as in the past, it is a working partner, supplying technical assistance and raw-material chemicals to those great companies marking milestones in glass progress.

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